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Funatsu

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(54) **IMAGE FORMATION APPARATUS WITH INITIAL VOLTAGE POLARITY SETTING**

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G03G 15/06 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/065*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/065; G03G 15/0806
USPC 399/55
See application file for complete search history.

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP H10-105016 A 4/1998

Primary Examiner — William J Royer
(74) *Attorney, Agent, or Firm* — Mots Law, PLLC

(57) **ABSTRACT**

An image formation apparatus includes an image carrier; a charge member; an exposure unit; a development member; a measurement unit that measures a stop time period when a rotation of the image carrier is being stopped, or a physical amount that varies as the stop time period increases; a setting unit that sets a polarity of an initial voltage to be applied to the development member, the polarity being determined based on the stop time period or the physical amount measured by the measurement unit; and a power source unit that applies the initial voltage with the polarity set by the setting unit to the development member, at rotation start time of the image carrier.

11 Claims, 14 Drawing Sheets

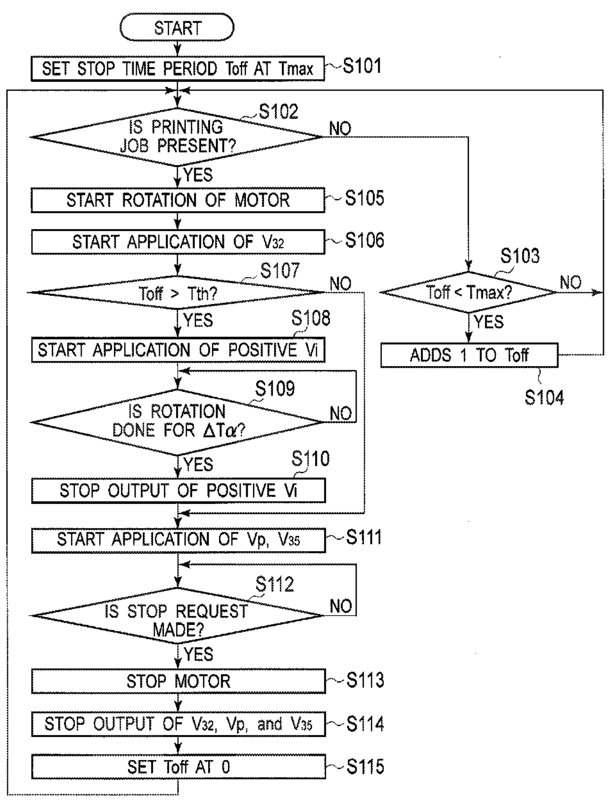
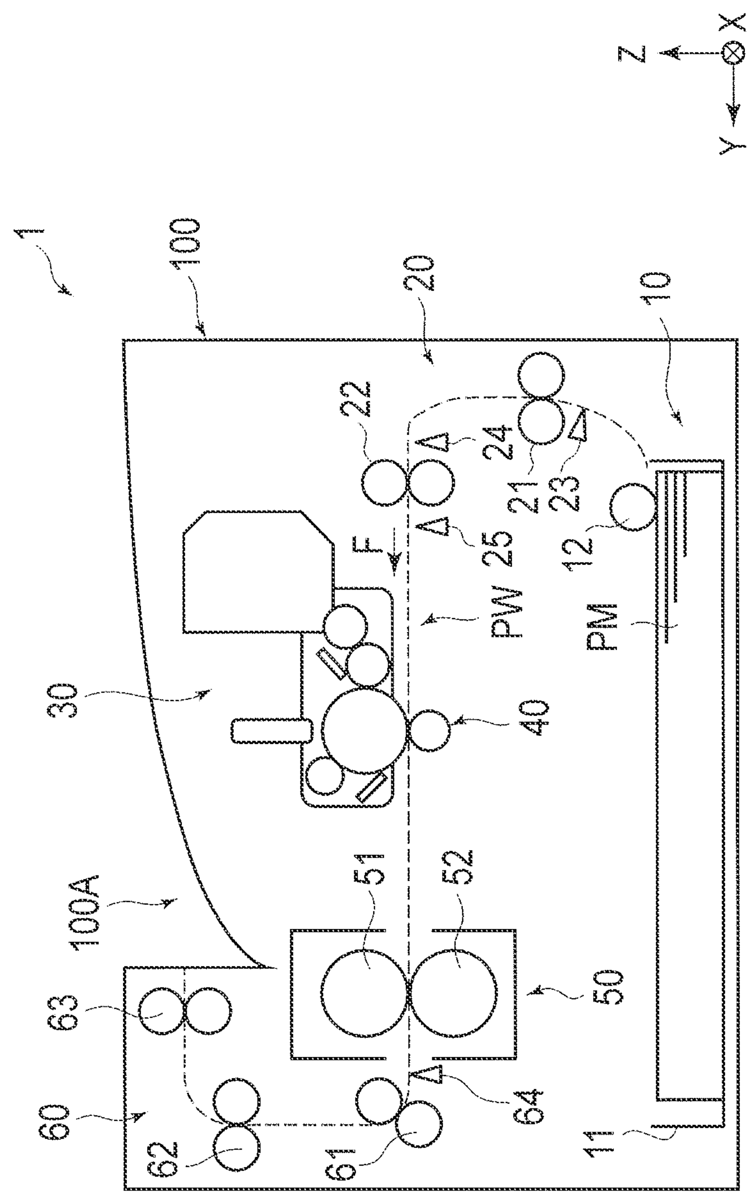


FIG. 1



Z
X
Y
1
100
20
10
22
24
21
23
25
12
F
PW
PM
30
40
100A
51
52
50
63
60
62
61
64
11

FIG. 2

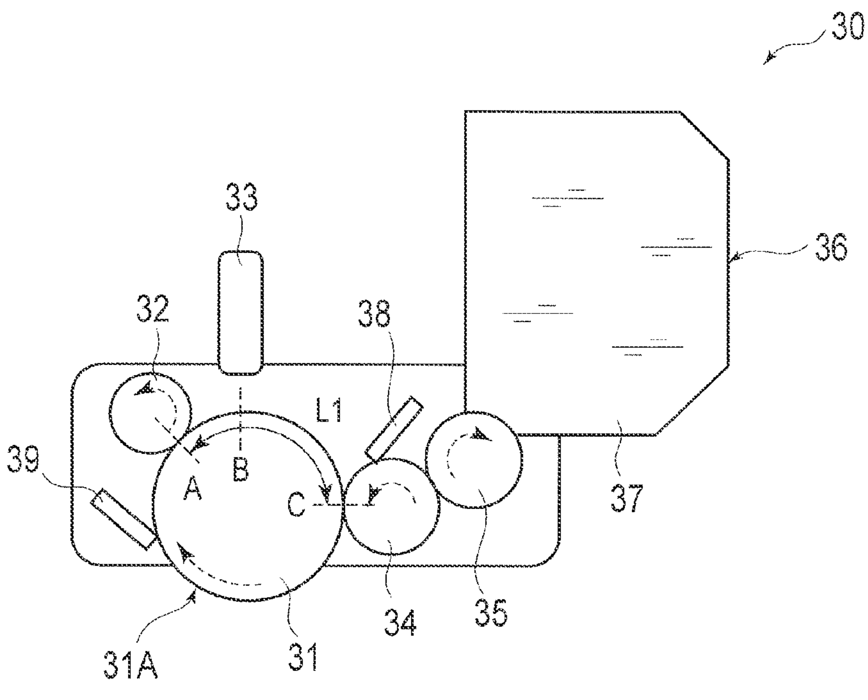


FIG. 3

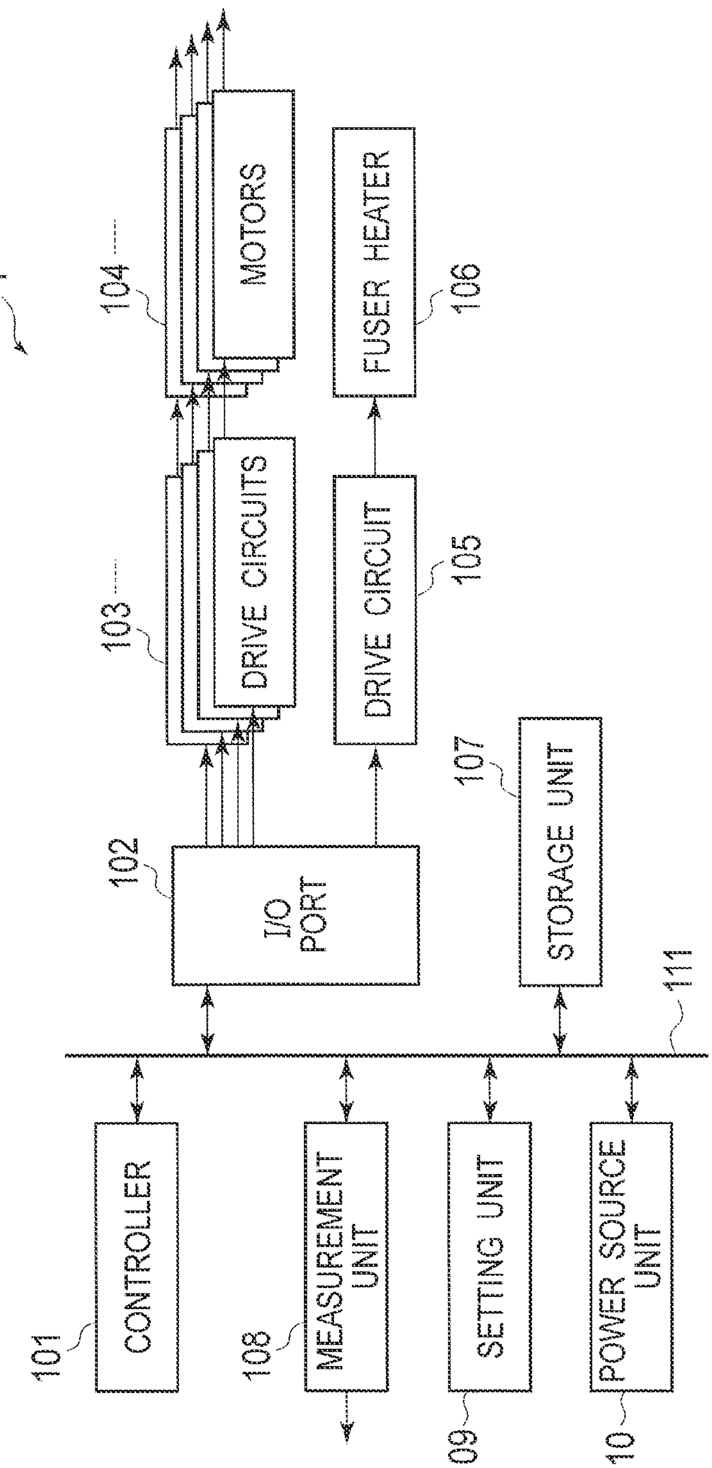

1
104
MOTORS
103
DRIVE CIRCUITS
FUSER HEATER
106
DRIVE CIRCUIT
105
102
I/O PORT
107
STORAGE UNIT
111
101
CONTROLLER
108
MEASUREMENT UNIT
SETTING UNIT
109
POWER SOURCE UNIT
110

FIG. 4

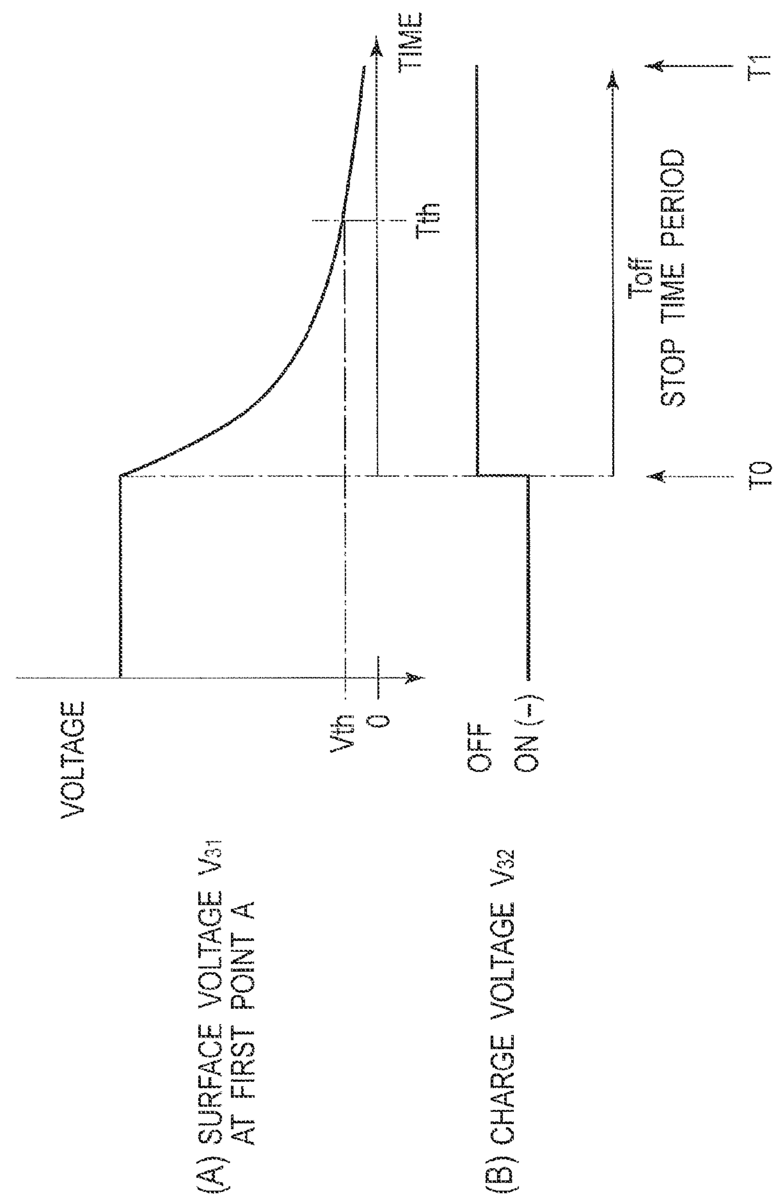

(A) SURFACE VOLTAGE V31
AT FIRST POINT A
VOLTAGE
Vth
0
TIME
Tth
(B) CHARGE VOLTAGE V32
OFF
ON (−)
Toff
STOP TIME PERIOD
T0
T1

FIG. 5A

120 DEVELOPMENT VOLTAGE TABLE

T_{off}	V_{34}
t1	Va
t2	Va
t3	Vb
⋮	⋮
tn	Vb

V_{31} < Va < 0volt

Vb > 0volt

FIG. 5B

130 DEVELOPMENT VOLTAGE FUNCTION

$V_{34}=f_1(T_{off})$

FIG. 6

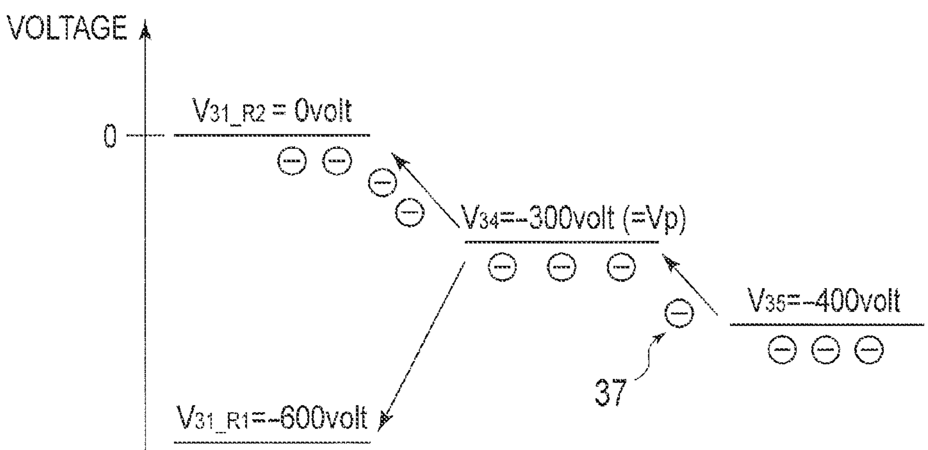


FIG. 7

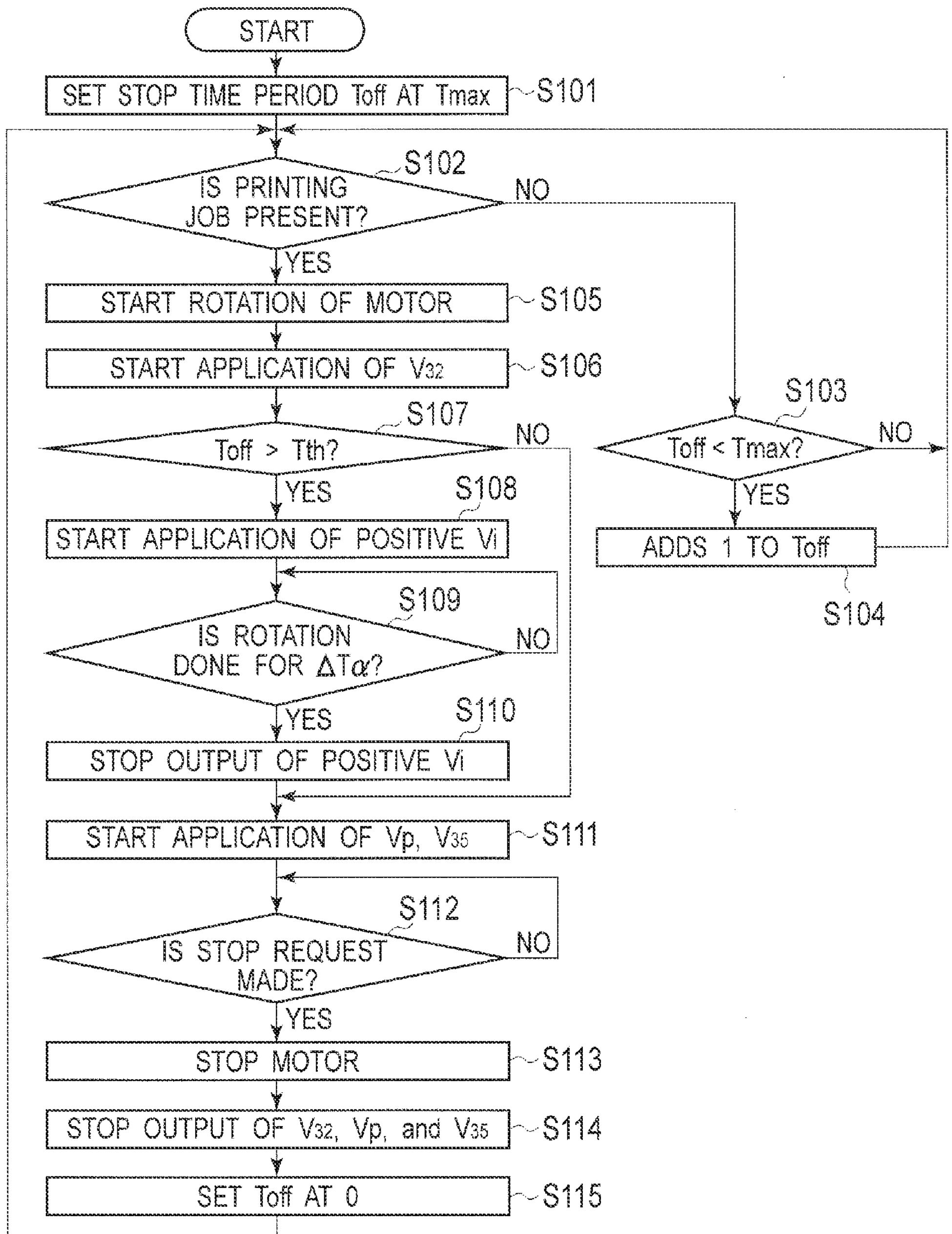

START
SET STOP TIME PERIOD Toff AT Tmax
S101
IS PRINTING JOB PRESENT?
S102
NO
YES
START ROTATION OF MOTOR
S105
START APPLICATION OF V32
S106
Toff > Tth?
S107
NO
YES
START APPLICATION OF POSITIVE Vi
S108
IS ROTATION DONE FOR ΔTα?
S109
NO
YES
STOP OUTPUT OF POSITIVE Vi
S110
START APPLICATION OF Vp, V35
S111
IS STOP REQUEST MADE?
S112
NO
YES
STOP MOTOR
S113
STOP OUTPUT OF V32, Vp, and V35
S114
SET Toff AT 0
S115
Toff < Tmax?
S103
NO
YES
ADDS 1 TO Toff
S104

FIG. 8

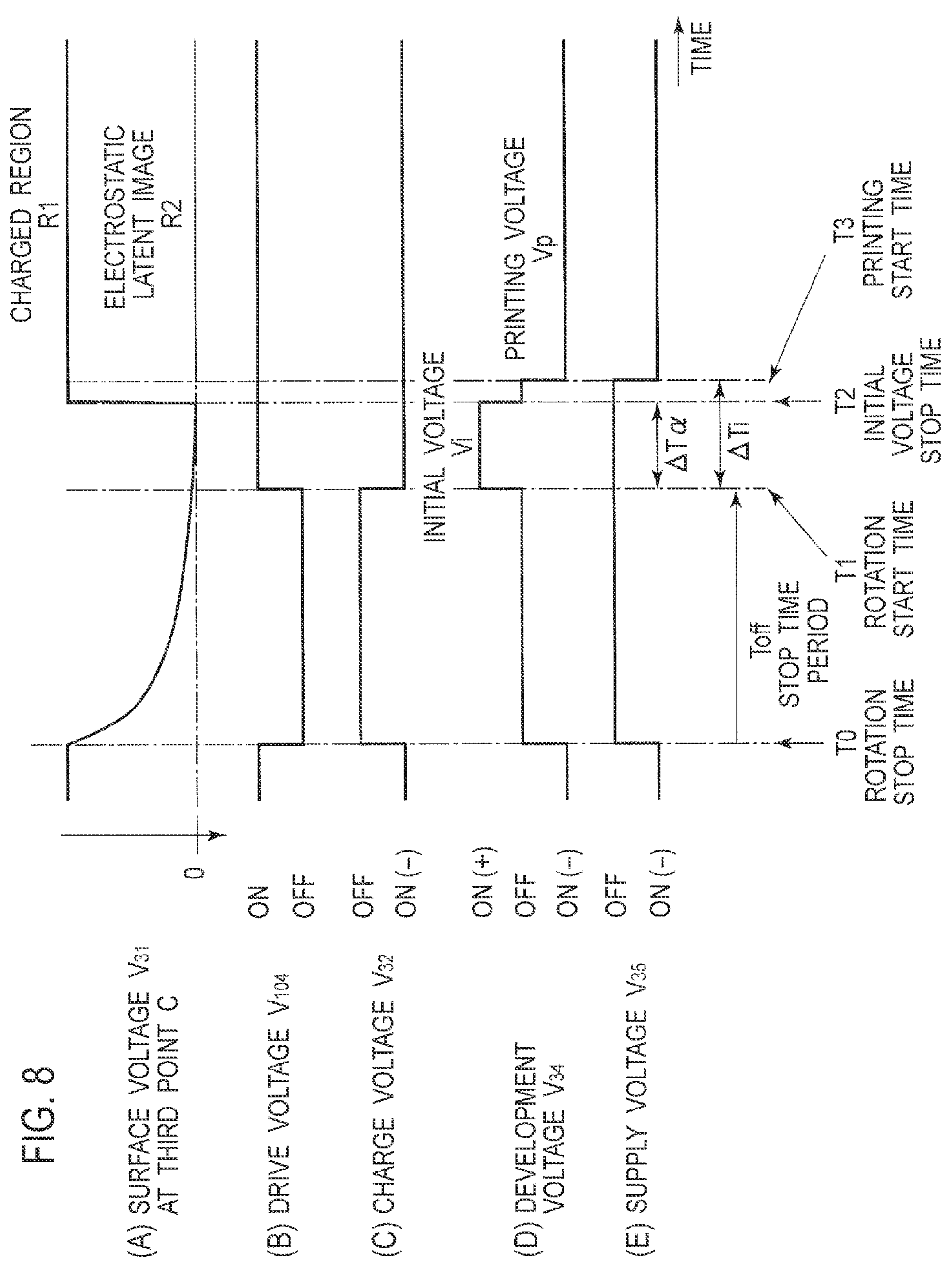

(A) SURFACE VOLTAGE V31 AT THIRD POINT C
(B) DRIVE VOLTAGE V104
(C) CHARGE VOLTAGE V32
(D) DEVELOPMENT VOLTAGE V34
(E) SUPPLY VOLTAGE V35
0
ON
OFF
OFF
ON (−)
ON (+)
OFF
ON (−)
OFF
ON (−)
CHARGED REGION R1
ELECTROSTATIC LATENT IMAGE R2
INITIAL VOLTAGE Vi
PRINTING VOLTAGE Vp
ΔTα
ΔTi
Toff STOP TIME PERIOD
T0 ROTATION STOP TIME
T1 ROTATION START TIME
T2 INITIAL VOLTAGE STOP TIME
T3 PRINTING START TIME
TIME

FIG. 9

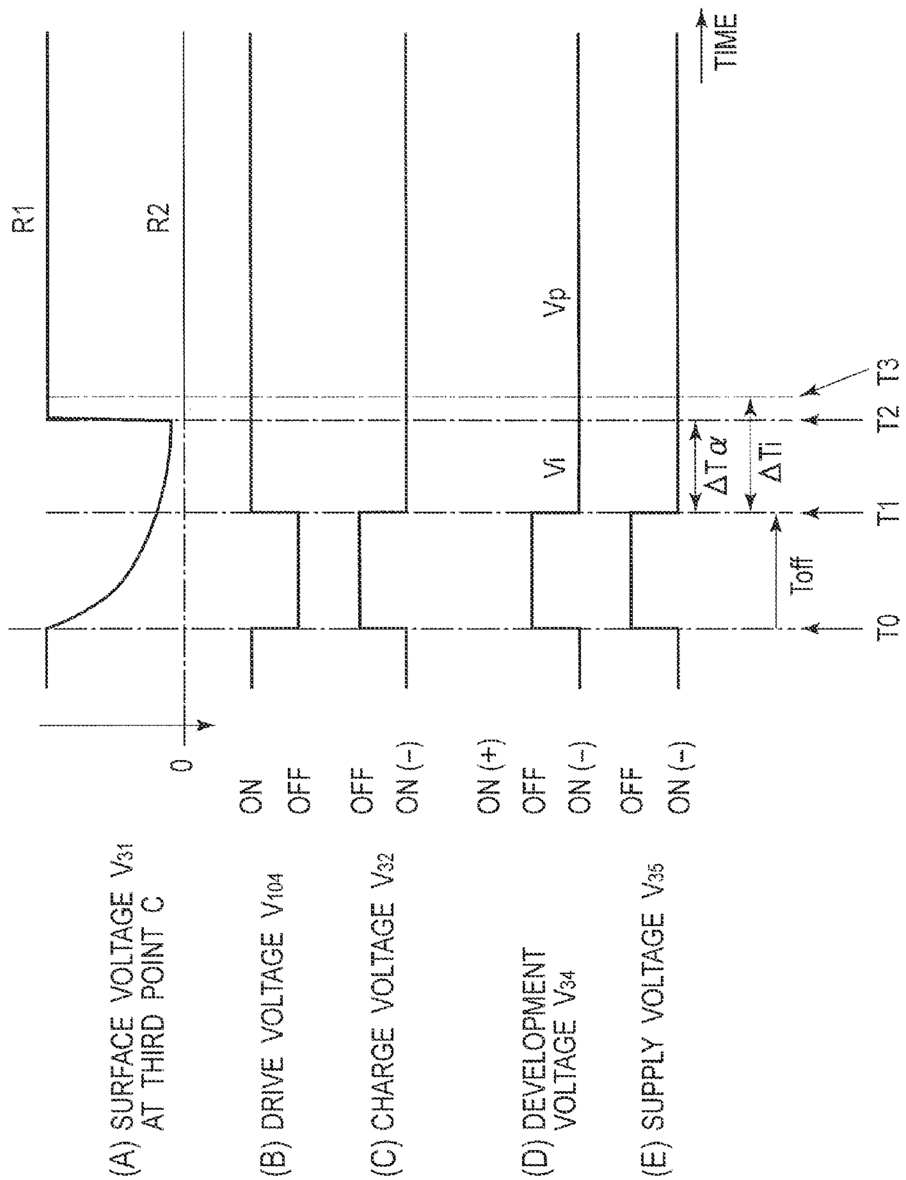

(A) SURFACE VOLTAGE V31 AT THIRD POINT C
(B) DRIVE VOLTAGE V104
(C) CHARGE VOLTAGE V32
(D) DEVELOPMENT VOLTAGE V34
(E) SUPPLY VOLTAGE V35
0
ON
OFF
OFF
ON (−)
ON (+)
OFF
ON (−)
OFF
ON (−)
R1
R2
Vp
Vi
ΔTα
ΔTi
Toff
T0
T1
T2
T3
TIME

FIG. 10A

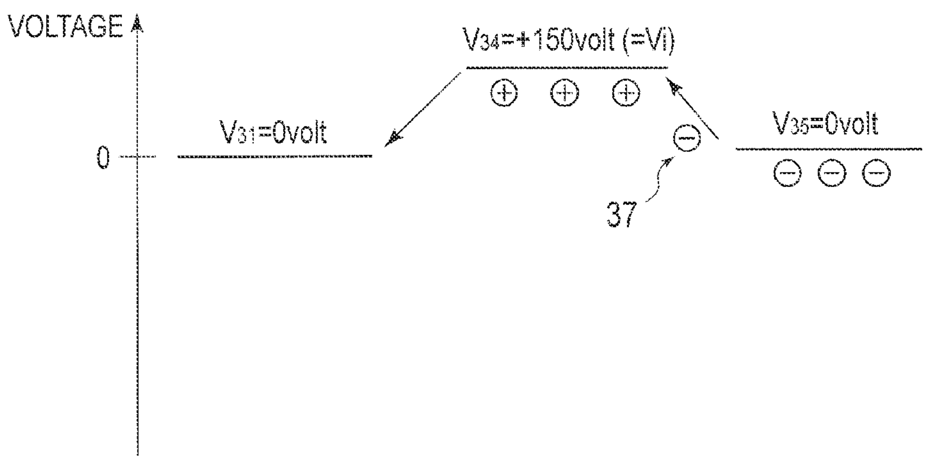


FIG. 10B

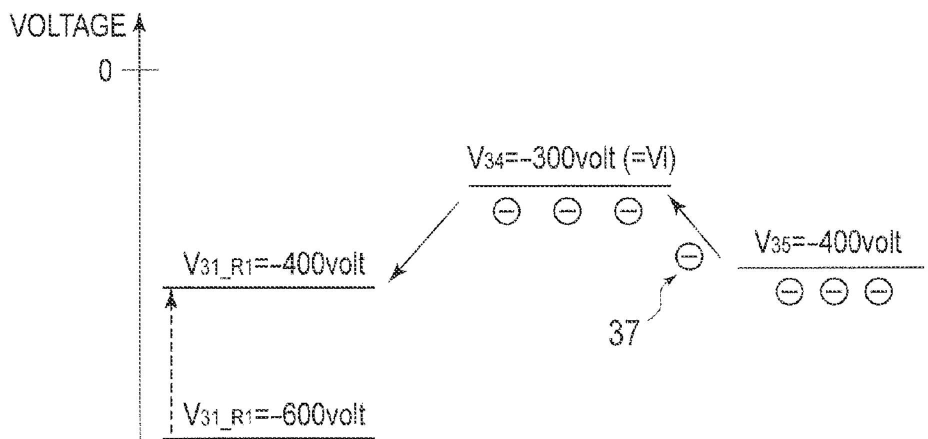


FIG. 11

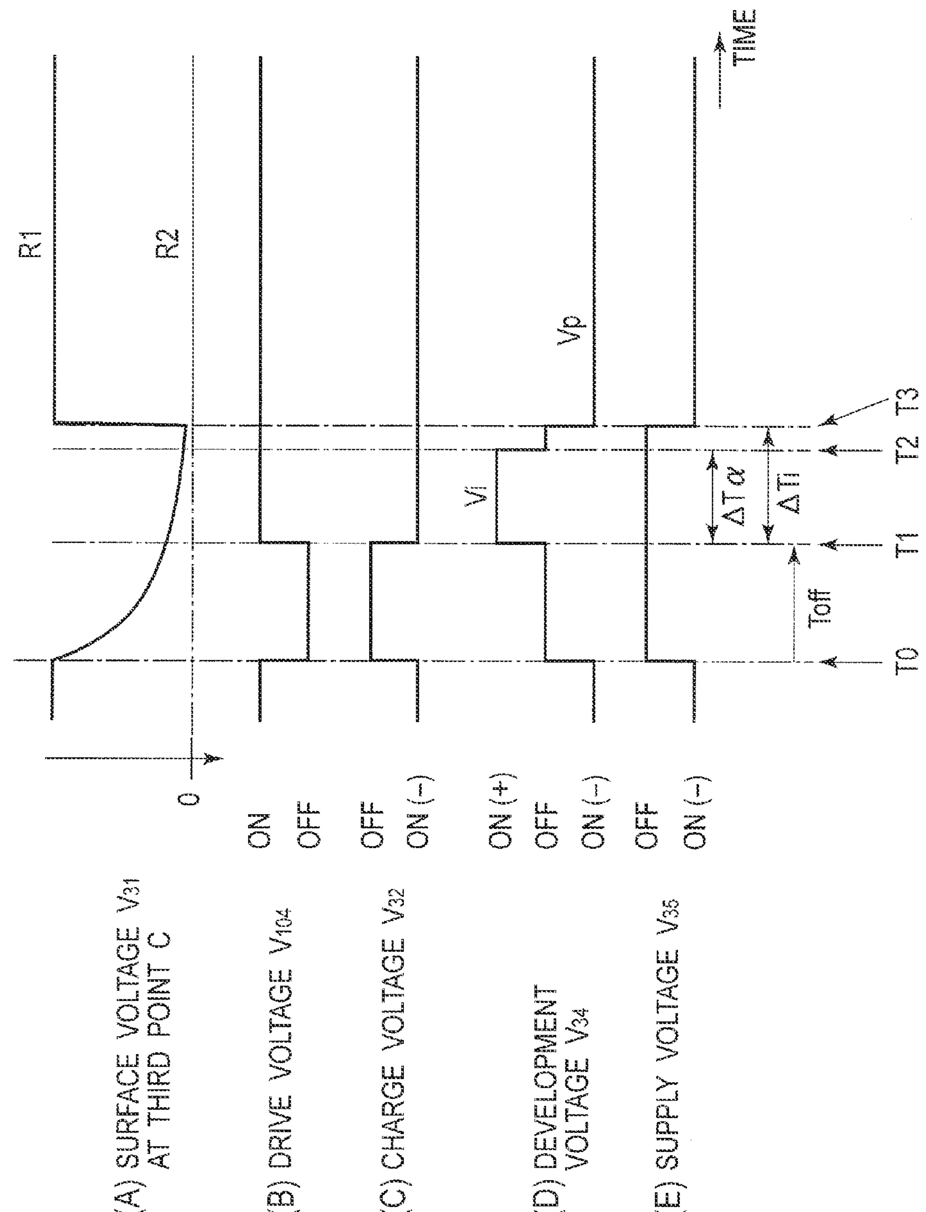

(A) SURFACE VOLTAGE V31 AT THIRD POINT C
(B) DRIVE VOLTAGE V104
(C) CHARGE VOLTAGE V32
(D) DEVELOPMENT VOLTAGE V34
(E) SUPPLY VOLTAGE V35
0
ON
OFF
OFF
ON (−)
ON (+)
OFF
ON (−)
OFF
ON (−)
R1
R2
Vp
Vi
ΔTα
ΔTi
Toff
T0
T1
T2
T3
TIME

FIG. 12

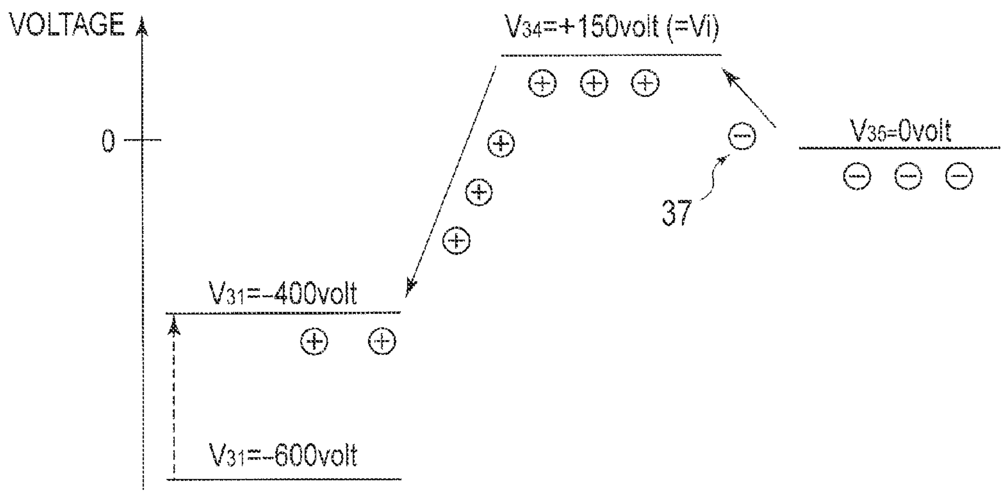


FIG. 13A

140 POLAR TABLE

T_{off}	POLARITY P_{34} OF V_{34}
t1	–
t2	–
t3	+
⋮	⋮
tn	+

FIG. 13B

150 POLAR FUNCTION

POLARITY P_{34} OF $V_{34}=f_2(T_{off})$

FIG. 14

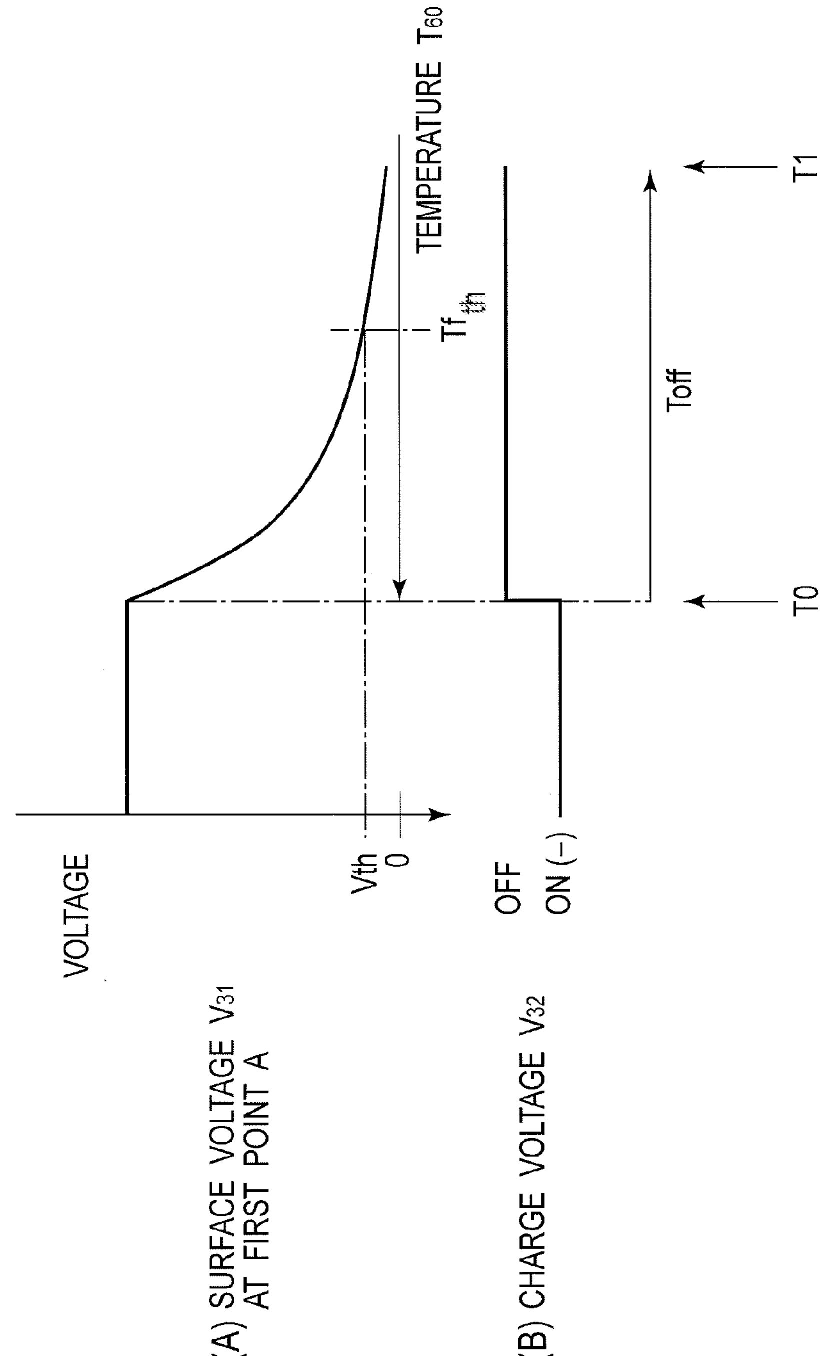

(A) SURFACE VOLTAGE V_{31} AT FIRST POINT A
(B) CHARGE VOLTAGE V_{32}
VOLTAGE
Vth
0
OFF
ON (−)
TEMPERATURE T_{60}
Tf_{th}
Toff
T0
T1

FIG. 15A

160 DEVELOPMENT VOLTAGE TABLE

T_{60}	V_{34}
Tf1	Va
Tf2	Va
Tf3	Vb
⋮	⋮
Tfn	Vb

FIG. 15B

170 DEVELOPMENT VOLTAGE FUNCTION

$V_{34}=f_3(T_{60})$

FIG. 16A

180 POLAR TABLE

T_{60}	POLARITY P_{34} OF V_{34}
Tf1	−
Tf2	−
Tf3	+
⋮	⋮
Tfn	+

FIG. 16B

190 POLAR FUNCTION

POLARITY P_{34} OF $V_{34}=f_4(T_{60})$

FIG. 17A

210 DEVELOPMENT VOLTAGE TABLE

V_{31}	V_{34}
V1	Va
V2	Va
V3	Vb
⋮	⋮
Vn	Vb

FIG. 17B

220 DEVELOPMENT VOLTAGE FUNCTION

$$V_{34} = f_5(T_{31})$$

IMAGE FORMATION APPARATUS WITH INITIAL VOLTAGE POLARITY SETTING

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority based on 35 USC 119 from prior Japanese Patent Application No. 2015-016723 filed on Jan. 30, 2015, entitled "IMAGE FORMATION APPARATUS", the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The disclosure relates to an electrophotographic image formation apparatus.

2. Description of Related Art

In electrophotographic image formation apparatuses, the surface voltage of a photosensitive drum is close to 0 volt immediately after a power supply is turned on or when a development unit is started up after a long standby state. When a normal development process is executed in that state, a negative voltage is applied to a development roller to negatively charge a developer on the development roller. In this process, a potential difference between the photosensitive drum and the development roller is generated, so that the negatively charged developer on the development roller is attracted to the photosensitive drum and consequently is wastefully consumed. To cope with this situation, for example, Japanese Patent Application Publication No. 10-105016 discloses a technology of preventing a developer from being attracted to a photosensitive drum by applying a positive voltage to a development roller until a region of a peripheral surface of the photosensitive drum, where the surface voltage of the photosensitive drum is close to 0 volt, finishes passing the development roller.

SUMMARY OF THE INVENTION

In an image formation apparatus disclosed in Japanese Patent Application Publication No. 10-105016, there is a case where an operation such as printing is ended and the photosensitive drum is temporarily stopped, and immediately after the temporal stop, an operation such as printing is started again. In such a case, the photosensitive drum sometimes starts to rotate before the surface voltage of the photosensitive drum is attenuated. If a positive voltage is applied to the development roller in that condition, a developer positively charged on the development roller is strongly attracted to the surface of the negatively charged photosensitive drum, and is consequently wastefully consumed.

An object of an embodiment of the invention is to provide an image formation apparatus capable of reducing the wasteful consumption of a developer.

An aspect of the invention is an image formation apparatus that includes: an image carrier including a peripheral surface with a photosensitive element; a charge member placed facing the peripheral surface and configured to charge the peripheral surface; an exposure unit that exposes a charged region of the peripheral surface charged by the charge member with light to form an electrostatic latent image; a development member placed facing the peripheral surface at a position downstream of the charge member in a rotation direction of the image carrier, and configured to develop the electrostatic latent image with a developer; a measurement unit that measures a stop time period when a rotation of the image carrier is being stopped, or a physical amount that varies as the stop time period increases; a setting unit that sets a polarity of an initial voltage to be applied to the development member, the polarity determined based on the stop time period or on the physical amount measured by the measurement unit; and a power source unit that applies the initial voltage with the polarity set by the setting unit to the development member, at rotation start time of the image carrier.

According to the aspect of the invention, the wasteful consumption of the developer can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram illustrating a schematic configuration example of an image formation apparatus according to one embodiment of the invention;

FIG. **2** is a schematic diagram illustrating a schematic configuration example of an image formation unit in FIG. **1**;

FIG. **3** is a schematic diagram illustrating an example of a part of a control mechanism of the image formation apparatus in FIG. **1**;

FIG. **4** shows waveform diagrams (A) and (B) illustrating examples of time-dependent changes in the voltage of a photosensitive drum and a charge roller;

FIG. **5**A is a diagram illustrating an example of a development voltage table;

FIG. **5**B is a diagram illustrating an example of a development voltage function;

FIG. **6** is a schematic diagram illustrating the respective voltages of the photosensitive drum, a development roller, and a supply roller, and the transition of a developer, when a developer image is formed;

FIG. **7** is a flowchart illustrating an example of a procedure of an operation of the image formation apparatus;

FIG. **8** shows waveform diagrams (A) to (E) illustrating examples of various kinds of waveforms in the image formation apparatus;

FIG. **9** shows waveform diagrams (A) to (E) illustrating examples of various kinds of waveforms in the image formation apparatus;

FIG. **10**A is a schematic diagram illustrating the respective voltages of the photosensitive drum, the development roller, and the supply roller, and the transition of the developer, when a positive voltage is applied as an initial voltage of the development roller;

FIG. **10**B is a schematic diagram illustrating the respective voltages of the photosensitive drum, the development roller, and the supply roller, and the transition of the developer, when a negative voltage is applied as an initial voltage of the development roller;

FIG. **11** shows waveform diagrams (A) to (E) illustrating examples of various kinds of waveforms in an image formation apparatus according to a comparative example;

FIG. **12** is a schematic diagram illustrating the respective voltages of a photosensitive drum, a development roller, and a supply roller, and the transition of a developer, when a positive voltage is applied as an initial voltage of the development roller, in the image formation apparatus according to the comparative example;

FIG. **13**A is a diagram illustrating an example of a polar table;

FIG. **13**B is a diagram illustrating an example of a polar function;

FIG. **14** shows waveform diagrams (A) and (B) illustrating examples of the voltage of the photosensitive drum and a charge roller;

FIG. **15**A is a diagram illustrating an example of a development voltage table;

FIG. **15**B is a diagram illustrating an example of a development voltage function;

FIG. **16**A is a diagram illustrating an example of a polar table;

FIG. **16**B is a diagram illustrating an example of a polar function;

FIG. **17**A is a diagram illustrating an example of a development voltage table; and

FIG. **17**B is a diagram illustrating an example of a development voltage function.

DETAILED DESCRIPTION OF EMBODIMENTS

Descriptions are provided hereinbelow for embodiments based on the drawings. In the respective drawings referenced herein, the same constituents are designated by the same reference numerals and a duplicate explanation concerning the same constituents is omitted. All of the drawings are provided to illustrate the respective examples only.

Hereinafter, embodiments of the invention are described in detail with reference to the drawings. The following explanation is merely one specific example of the invention, and the invention is not limited to the aspects below. Moreover, in the invention, placements, sizes, ratios of the sizes, and the like, of respective components are not limited to those illustrated in the drawings. The explanation is made in the following order.

1. Embodiment

An example in which the polarity of a development roller is set based on a stop time period.

2. Modification Examples

First modification example: another example in which the polarity of the development roller is set based on a stop time period.

Second modification example: an example in which the polarity of the development roller is set based on the temperature of a fixation unit.

Third modification example: another example in which the polarity of the development roller is set based on the temperature of the fixation unit.

Fourth modification example: an example in which the polarity of the development roller is set based on the surface voltage of a photosensitive drum.

Fifth modification example: an example in which the polarity of the development roller is set based on the environment in a housing.

Sixth modification example: various kinds of modification examples.

<1. Embodiment>

[Configuration]

FIG. **1** schematically illustrates a schematic configuration example of image formation apparatus **1** according to one embodiment of the invention. Image formation apparatus **1** is a printer that forms an image on medium PM using an electrophotographic system. Media PM are, for example, single-cut sheets. Image formation apparatus **1** is provided with paper feed unit **10**, conveyance unit **20**, image formation unit **30**, transfer unit **40**, fixation unit **50**, and delivery unit **60**. Paper feed unit **10**, conveyance unit **20**, image formation unit **30**, transfer unit **40**, fixation unit **50**, and delivery unit **60** are provided inside housing **100**.

In the description, a path along which medium PM is conveyed is called conveyance path PW. In conveyance path PW, "upstream in conveyance path PW" indicates a direction toward paper feed unit **10** from a given component or a position located closer to paper feed unit **10** than the given component is located. In conveyance path PW, "downstream of conveyance path PW" indicates a direction opposite to the direction toward paper feed unit **10** from a given component, or a position located farther from paper feed unit **10** than the given component is located. In conveyance path PW, conveyance direction F indicates a direction in which medium PM travels (in other words, a direction from the upstream of conveyance path PW toward the downstream of conveyance path PW).

(Configuration of Paper Feed Unit **10**)

Paper feed unit **10** is configured to supply media PM one by one in conveyance path PW. Paper feed unit **10** includes, for example, paper feed tray **11** and pickup roller **12**. Paper feed tray **11** contains media PM being stacked. Paper feed tray **11** is mounted to, for example, a lower portion of image formation apparatus **1** in an attachable and detachable manner. Pickup roller **12** supplies medium PM that is contained in paper feed tray **11** to conveyance unit **20**. Pickup roller **12** performs a rotation operation in a direction to allow medium PM to be fed out onto conveyance path PW under the control of controller **101**, which is described later in FIG. **3**.

(Configuration of Conveyance Unit **20**)

Conveyance unit **20** is configured to convey medium PM from paper feed unit **10** to transfer unit **40** along conveyance path PW while restricting any tilting of medium PM. Conveyance unit **20** is placed downstream of paper feed unit **10** in conveyance path PW. Conveyance unit **20** includes, for example, pairs of registration rollers **21** and **22**, and sensors **23**, **24**, and **25**.

Pair of registration rollers **21** is placed upstream of pair of registration rollers **22** in conveyance path PW, and specifically, is placed between paper feed tray **11** and pair of registration rollers **22**. Pair of registration rollers **21** performs a contact process on medium PM that is conveyed through conveyance path PW, and thereafter conveys medium. PM in conveyance direction F along conveyance path PW. The contact process indicates a process to bring a leading edge of medium PM conveyed from paper feed unit **10** into contact with a pair of registration rollers **21** which stop rotating. While the contact process is performed, no power of motor **104** (which is described later in FIG. **3**) that is controlled by controller **101** is transmitted to pair of registration rollers **21**. In other words, pair of registration rollers **21** stops rotating while performing the contact process. Then, when conveying medium PM, pair of registration rollers **21** performs a rotation operation in a direction to convey medium PM in conveyance direction F under the control of controller **101**. Sensor **23** is placed upstream of pair of registration rollers **21** in conveyance path PW. Sensor **23** detects a position of medium PM so as to adjust a drive timing of pair of registration rollers **21**. Sensor **23** detects, for example, medium PM being conveyed along conveyance path PW.

Pair of registration rollers **22** is placed downstream of pair of registration rollers **21** in conveyance path PW, and is placed between sensor **24** and sensor **25**, for example. Pair of registration rollers **22** conveys medium PM conveyed through conveyance path PW along conveyance path PW in conveyance direction F. Pair of registration rollers **22** performs a rotation operation to convey medium PM in conveyance direction F under the control of controller **101**. Sensor **24** is placed upstream of pair of registration rollers **22** and sensor **25**, in conveyance path PW. Sensor **24** detects a position of medium PM so as to adjust a drive timing of pair of registration rollers **22**. Sensor **24** detects medium PM that is conveyed through conveyance path PW. Sensor **25** is placed downstream of sensor **24** in conveyance path PW. Sensor **25** detects a position of medium PM so as to adjust a timing for image formation in image formation unit **30**. Sensor **25** detects medium PM that is conveyed through conveyance path PW.

(Configuration of Image Formation Unit **30**)

FIG. **2** schematically illustrates a schematic configuration example of image formation unit **30**. Image formation unit **30** is placed downstream of conveyance unit **20** in conveyance path PW. Image formation unit **30** is configured to form an image onto peripheral surface **31**A of photosensitive drum **31**, which is described later. Image formation unit **30** includes photosensitive drum **31**, charge roller **32**, light emitting diode (LED) head **33**, development roller **34**, supply roller **35**, cartridge **36**, regulation blade **38**, and cleaning blade **39**, for example, as illustrated in FIG. **2**. Cartridge **36** is filled with developer **37**. Photosensitive drum **31** corresponds to a specific example of a "photosensitive drum" of the invention. Peripheral surface **31**A corresponds to a specific example of a "peripheral surface" of the invention. Charge roller **32** corresponds to a specific example of a "charge member" of the invention. LED head **33** corresponds to a specific example of an "exposure unit" of the invention. Development roller **34** corresponds to a specific example of a "development member" of the invention. Developer **37** corresponds to a specific example of "developer" of the invention.

Photosensitive drum **31** includes peripheral surface **31**A with a photosensitive element (for example, an organic photosensitive element), and is a cylindrical member that can support an electrostatic latent image on peripheral surface **31**A. Specifically, photosensitive drum **31** includes a conductive support, and a photoconductive layer that covers an outer circumference (surface) thereof. The conductive support is configured to include, for example, a metal pipe made of aluminum. The photoconductive layer includes a structure, for example, in which a charge generation layer and a charge transport layer are sequentially stacked. Photosensitive drum **31** performs a rotation operation to convey medium PM in conveyance direction F at a predetermined circumferential speed under the control of controller **101**.

Charge roller **32** is a member (charge member) that charges peripheral surface **31**A of photosensitive drum **31**. Charge roller **32** is placed so as to come into contact with peripheral surface **31**A of photosensitive drum **31**, and is placed facing peripheral surface **31**A at first point A. First point A corresponds to a point indicated as "A" in FIG. **2**. Charge roller **32** includes, for example, a metal shaft made of stainless steel, and a semiconducting elastic layer (for example, a semiconducting epichlorohydrin rubber layer) that covers an outer circumference (surface) thereof. Charge roller **32** performs a rotation operation in a direction opposite to the direction of the rotation of photosensitive drum **31** by the transmission of a drive force from photosensitive drum **31**, for example.

LED head **33** is an exposure device that exposes charged region R**1** of peripheral surface **31**A that is charged by charge roller **32** to light to form electrostatic latent image R**2** in charged region R**1** of peripheral surface **31**A. Charged region R**1** corresponds to a specific example of a "charged region" of the invention. Electrostatic latent image R**2** corresponds to a specific example of an "electrostatic latent image" of the invention. Note that, charged region R**1** and electrostatic latent image R**2** are illustrated in FIG. **8**, which is described later. LED head **33** is placed facing peripheral surface **31**A at second point B that is positioned downstream of first point A in the rotation direction of photosensitive drum **31**. Second point B corresponds to a point indicated as "B" in FIG. **2**. LED head **33** includes a plurality of LED light emitters that are arranged in the width direction of photosensitive drum **31**. Each LED light emitter is configured to include, for example, a light source, such as a light-emitting diode, that emits irradiation light, and a lens array that forms an image with the irradiation light on the surface of photosensitive drum **31**.

Development roller **34** is a member that supports developer **37** on a surface thereof, and develops electrostatic latent image R**2** with developer **37**. Development roller **34** is placed so as to come into contact with peripheral surface **31**A of photosensitive drum **31**, and is placed facing peripheral surface **31**A at third point C that is positioned downstream of second point B in the rotation direction of photosensitive drum **31**. Third point C corresponds to a point indicated as "C" in FIG. **2**. Development roller **34** includes, for example, a metal shaft made of stainless steel, and a semiconducting elastic layer (for example, a semiconducting urethane rubber layer) that covers an outer circumference (surface) thereof. Development roller **34** performs a rotation operation in the direction opposite to the direction of the rotation of photosensitive drum **31** at a predetermined circumferential speed by the transmission of a drive force from photosensitive drum **31**, for example.

Herein, for example, assume that photosensitive drum **31** has a diameter of 40 mm, and charge roller **32** and development roller **34** are placed at positions forming an angle of 120° with the center of photosensitive drum **31** as an axis. In this arrangement, distance L1 from first point A to third point C is approximately 41.89 mm.

Supply roller **35** is a member (supply member) that supplies developer **37** to development roller **34**, and is placed so as to come into contact with a surface (peripheral surface) of development roller **34**. Supply roller **35** includes, for example, a metal shaft, and a foaming elastic layer (for example, a silicone rubber layer) that covers an outer circumference (surface) thereof. Supply roller **35** performs a rotation operation in the direction opposite to the direction of rotation of development roller **34** by the transmission of a drive force from development roller **34**, for example.

Cartridge **36** is a container in which developer **37** is contained. Regulation blade **38** regulates the layer thickness of developer **37** that is supported on the surface of development roller **34**. Developer **37** is, for example, a non-magnetic one-component developer. Regulation blade **38** is made of, for example, a stainless steel sheet, also known as a stainless use sheet SUS, being an acronym from the Japanese Industrial Standards. Cleaning blade **39** scrapes off developer **37** remaining on the surface of photosensitive drum **31**. Cleaning blade **39** is made of, for example, a flexible rubber material or plastic material.

(Configuration of Transfer Unit **40**)

Transfer unit **40** is configured to electrostatically transfer an image (developer image) that is formed on peripheral surface **31**A of photosensitive drum **31** onto medium PM that is conveyed from conveyance unit **20**. Transfer unit **40** is configured to include, for example, a transfer roller. The transfer roller is placed facing photosensitive drum **31**. The transfer roller is made of, for example, a foaming semiconducting elastic rubber material.

(Configuration of Fixation Unit **50**)

Fixation unit **50** is a member that applies heat and pressure to a developer image that is formed on medium PM, after passing transfer unit **40**, to fix the developer image onto medium PM. Fixation unit **50** is placed at the downstream side of transfer unit **40** in conveyance path PW. Fixation unit **50** is configured to include, for example, upper roller **51** and lower roller **52**.

Upper roller **51** and lower roller **52** are configured for each to include a heat source (fuser heater **106** described later in FIG. **3**) that is a heater such as a halogen lamp in the inside thereof. Upper roller **51** and lower roller **52** function as heat rollers that apply heat to the developer image on medium PM. Upper roller **51** performs a rotation operation to convey medium. PM in conveyance direction F under the control of controller **101**. The heat sources in upper roller **51** and lower roller **52** are configured to respectively control the surface temperatures of upper roller **51** and lower roller **52** by being supplied with a bias voltage that is controlled by controller **101**. Lower roller **52** is placed facing upper roller **51** so as to allow a pressure contact portion to be formed with upper roller **51**, and functions as a pressurization roller that applies pressure to the developer image on medium PM. Lower roller **52** may preferably include a surface layer made of an elastic material.

(Configuration of Delivery Unit **60**)

Delivery unit **60** is configured to deliver medium PM on which a developer image is fixed by fixation unit **50** to the outside. Delivery unit **60** includes, for example, pairs of conveyance rollers **61**, **62** and **63**, and sensor **64**. Pairs of conveyance rollers **61**, **62** and **63** deliver medium PM to the outside through conveyance path PW, and cause delivered medium PM to be stacked in external stacker **100**A. Pairs of conveyance rollers **61**, **62**, and **63** perform rotation operations to convey medium PM in conveyance direction F under the control of controller **101**. Pairs of conveyance rollers **61**, **62**, and **63** further deliver medium PM facedown to the outside, for example.

Sensor **64** is placed upstream of pairs of conveyance rollers **61**, **62**, and **63** in conveyance path PW. Sensor **64** detects a position of medium PM so as to adjust the drive timings of pairs of conveyance rollers **61**, **62**, and **63**. Sensor **64** detects, for example, medium PM that is conveyed through conveyance path PW.

(Control Mechanism)

The following describes a part of the control mechanism of image formation apparatus **1**, with reference to FIG. **3** in addition to FIG. **1**. FIG. **3** is a block diagram illustrating an example of a part of the control mechanism of image formation apparatus **1**.

As illustrated in FIG. **1** and FIG. **3**, image formation apparatus **1** includes, as the control mechanism, for example, controller **101**, I/O port **102**, drive circuits **103**, motors **104**, drive circuit **105**, fuser heater **106**, and storage unit **107**. Image formation apparatus **1** further includes, as the control mechanism, for example, measurement unit **108**, setting unit **109**, and power source unit **110**. Storage unit **107** corresponds to a specific example of a "storage unit" of the invention. Measurement unit **108** corresponds to a specific example of a "measurement unit" of the invention. Setting unit **109** corresponds to a specific example of a "setting unit" of the invention. Power source unit **110** corresponds to a specific example of a "power source unit" of the invention. Controller **101**, I/O port **102**, drive circuits **103**, motors **104**, drive circuit **105**, fuser heater **106**, storage unit **107**, measurement unit **108**, setting unit **109**, and power source unit **110** are connected to control line **111**, for example.

Controller **101** controls various kinds of controlled components in image formation apparatus **1** via control line **111**, for example. I/O port **102** outputs control signals for driving various kinds of motors **104** for driving to various kinds of drive circuits **103** under the control of controller **101**. I/O port **102** further outputs a control signal for driving fuser heater **106** to drive circuit **105** under the control of controller **101**. Drive circuits **103** perform pulse controls of motors **104** that rotate various kinds of drums or various kinds of rollers under the control of I/O port **102**. Drive circuit **103** for photosensitive drum **31** performs a pulse control of motor **104** that rotates photosensitive drum **31**.

Drive circuit **105** performs a pulse control of fuser heater **106**. Fuser heaters **106** are respectively provided inside upper roller **51** and lower roller **52**, and heat upper roller **51** and lower roller **52**. Fuser heaters **106** stop the heating of upper roller **51** and lower roller **52** in synchronization with a stop of the rotation of photosensitive drum **31**, or start the heating of upper roller **51** and lower roller **52** before a start of the rotation of photosensitive drum **31**. Fuser heater **106** is, for example, a heating heater such as a halogen lamp. Storage unit **107** stores therein a control program for operating image formation apparatus **1**. Storage unit **107** further stores therein development voltage table **120** (FIG. **5**A) or development voltage function **130** (FIG. **5**B), and threshold value T_{th} (FIG. **4**). Development voltage table **120** corresponds to a specific example of a "table" of the invention. Development voltage function **130** corresponds to a specific example of a "function" of the invention. Threshold value T_{th} corresponds to a specific example of a "first threshold value" of the invention.

Next, the following describes development voltage table **120** and development voltage function **130**. Waveform (A) in FIG. **4** illustrates an example of a time-dependent change in surface voltage V_{31} at first point A of photosensitive drum **31**. Waveform (B) in FIG. **4** illustrates an example of a time-dependent change in charge voltage V_{32}. Charge voltage V_{32} is a voltage to be applied to charge roller **32** so as to charge a surface (surface layer portion) of charge roller **32**. The time is elapsed toward the right side on the horizontal axes in waveforms (A) and (B) in FIG. **4**. The negative voltage becomes large toward the upper side on the longitudinal axis in waveform (A) in FIG. **4**. In FIG. **4**, T**0** represents the time when the rotation of photosensitive drum **31** is stopped (rotation stop time), and T_{off} represents a time period when the rotation of photosensitive drum **31** is being stopped, that is, a time period (stop time period) from rotation stop time T**0** to the time when the rotation of photosensitive drum **31** is started (rotation start time T**1**). Stop time period T_{off} corresponds to a specific example of a "stop time period" of the invention. Rotation start time T**1** corresponds to a specific example of a "rotation start time" of the invention.

Simultaneously with the stop of the rotation of photosensitive drum **31**, charge voltage V_{32} is cut off and becomes **0** volt. Surface voltage V_{31} at first point A of photosensitive drum **31** is then attenuated with the elapse of time, and eventually becomes **0** volt or a voltage close to **0** volt. Development voltage table **120** and development voltage function **130** contain data obtained by the measurement or the prediction of such attenuation of surface voltage V_{31}.

FIG. **5**A illustrates an example of development voltage table **120**. FIG. **5**B illustrates an example of development voltage function **130**. Development voltage table **120** is a table in which development voltage V_{34} is associated with stop time period T_{off}. Development voltage V_{34} is a voltage to be applied to development roller **34** so as to make the surface (surface layer portion) of development roller **34** have a negative potential. In development voltage table **120**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as stop time period T_{off} varies to t**1**, t**2**, t**3**, . . . , tn. Development voltage function **130** is a function in which development voltage V_{34} is associated with stop time period T_{off}. In development voltage function **130**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as stop time period T_{off} varies to t**1**, t**2**, t**3**, . . . , tn.

Herein, Va is a voltage higher than surface voltage V_{31} and lower than 0 volt. Va is a voltage having a negative polarity, and includes negative polar data. Vb is a voltage higher than 0 volt. Vb is a voltage having a positive polarity, and includes positive polar data. Accordingly, development voltage table **120** is also a table in which the polarity of development voltage V_{34} is associated with stop time period T_{off}. Moreover, development voltage function **130** is also a function in which the polarity of development voltage V_{34} is associated with stop time period T_{off}.

Next, the following describes measurement unit **108**, setting unit **109**, and power source unit **110**.

Measurement unit **108** measures stop time period T_{off}. Measurement unit **108** is a counter that measures the time by seconds, for example. Measurement unit **108** starts the measurement of a time, for example, when detecting a control signal that is outputted from I/O port **102**, and is used to stop the driving of motor **104** connected to photosensitive drum **31**. Measurement unit **108** outputs the measured time period (stop time period T_{off}) to controller **101**. Measurement unit **108** stops the measurement of time, for example, when detecting a control signal that is outputted from I/O port **102** and is used to stop the driving of motor **104** connected to photosensitive drum **31**. Measurement unit **108** may be configured separately from controller **101**, or may be configured as one of the functions of controller **101**.

Setting unit **109** sets the polarity of initial voltage Vi to be applied to development roller **34**, based on stop time period T_{off} measured by measurement unit **108**. Initial voltage Vi corresponds to a specific example of an "initial voltage" of the invention. Setting unit **109** uses development voltage table **120** or development voltage function **130** that is read from storage unit **107** to obtain polar data corresponding to stop time period T_{off} measured by measurement unit **108**, and sets the obtained polar data as the polarity of initial voltage Vi. Moreover, setting unit **109** uses development voltage table **120** or development voltage function **130** that is read from storage unit **107** to obtain polar data and development voltage data corresponding to stop time period T_{off} as measured by measurement unit **108**, and sets the polarity and a voltage value of initial voltage Vi based on the obtained polar data and development voltage data.

Setting unit **109** sets the polarity of initial voltage Vi to be negative when stop time period T_{off} measured by measurement unit **108** is not more than threshold value T_{th}. Setting unit **109** sets the polarity of initial voltage Vi to be positive when stop time period T_{off} measured by measurement unit **108** is more than threshold value T_{th}. Threshold value T_{th} is stop time period T_{off} when the voltage of electrostatic latent image R**2** on photosensitive drum **31** is at a predetermined value (threshold value V_{th}). Threshold value V_{th} is an upper limit value of surface voltage V_{31} of photosensitive drum **31** at which developer **37** is less likely to be attracted to photosensitive drum **31** even when the polarity of initial voltage Vi is positive. Further, threshold value T_{th} corresponds to stop time period t**2**, for example, in development voltage table **120** and development voltage function **130**.

Setting unit **109** sets a voltage value higher than voltage V_{31_R1}, which is described later in FIG. **6**, as a value of initial voltage Vi, when setting the polarity of initial voltage Vi to be negative. Voltage V_{31_R1} corresponds to a specific example of a "voltage value in the charged region" of the invention. When the polarity of initial voltage Vi is set to be negative, initial voltage Vi is preferably higher by at least 100 volts than voltage V_{31_R1} by considering the instability of surface voltage V_{31}. Herein, when a normal voltage (printing voltage Vp) to be applied to development roller **34** has a value of voltage higher than voltage V_{31_R1}, which is described later, setting unit **109** may set initial voltage Vi to a value equal to a value of printing voltage Vp. Printing voltage Vp is a voltage to be applied to development roller **34** at printing start time T**3** and during printing. Printing voltage Vp corresponds to a specific example of a "voltage value to be applied to the development member during printing" of the invention.

Setting unit **109** outputs information related to set initial voltage Vi to power source unit **110**. When setting unit **109** sets the polarity of initial voltage Vi, setting unit **109** outputs information related to the set polarity of initial voltage Vi to power source unit **110**. When setting unit **109** sets the polarity and a voltage value of initial voltage Vi, setting unit **109** outputs information related to the set polarity and voltage value of initial voltage Vi to power source unit **110**. Further, when the value of negative voltage capable of being outputted as initial voltage Vi is limited to one value of negative voltage in power source unit **110**, setting unit **109** does not necessarily provide the one value of negative voltage to power source unit **110**. Accordingly, in such a case, setting unit **109** may set only the polarity of initial voltage Vi without setting a voltage value of initial voltage Vi, and output only information related to the set polarity of initial voltage Vi to power source unit **110**.

Power source unit **110** applies initial voltage Vi with the polarity set by setting unit **109** to development roller **34** at rotation start time T**1** of photosensitive drum **31**. Power source unit **110** applies initial voltage Vi with the polarity set by setting unit **109** to development roller **34** within a period (rotation initial period ΔTi) from rotation start time T**1** to transfer start time (printing start time T**3**) of a developer image formed by development by development roller **34**. Rotation initial period ΔTi corresponds to a specific example of a "period from rotation start time to the transfer start time of a developer image formed by development by the development member" of the invention. When the polarity of initial voltage Vi set by setting unit **109** is negative, power source unit **110** may apply, to development roller **34**, initial voltage Vi with a voltage value equal to a voltage value (printing voltage Vp) to be applied to development roller **34** during printing. Note that, printing start time T**3** and rotation initial period ΔTi are exemplified in FIG. **8**, which is described later.

Power source unit **110** may apply initial voltage Vi to development roller **34** for a period that is only a part of rotation initial period ΔTi. Power source unit **110** may apply initial voltage Vi to development roller **34** only within a period, for example, from rotation start time T**1** to a time (initial voltage stop time T**2**) immediately before printing start time T**3**. Initial voltage stop time T**2** is the time when a portion of peripheral surface **31**A of photosensitive drum **31** located in first point A at rotation start time T**1** is moved to third point C with the rotation of photosensitive drum **31**. Further, initial voltage stop time T**2** is exemplified in FIG. **8**, which is described later.

[Operation]

Next, the following describes an overview of an operation of image formation apparatus **1**. In image formation apparatus **1**, a developer image is formed on medium PM in the following manner. When a printing job is supplied to controller **101** via a communication channel from an image transfer apparatus connected to image formation apparatus

1, controller **101** executes a printing process based on the printing job such that the respective members in image formation apparatus **1** perform the following operations.

Firstly, fuser heaters **106** start to heat upper roller **51** and lower roller **52**. When upper roller **51** and lower roller **52** reach a predetermined temperature, pickup roller **12** separates and takes out medium PM that is contained in paper feed tray **11** one by one from the upper-most part, and feeds out medium PM onto conveyance path PW. Next, pair of registration rollers **21** corrects the skew of medium PM by the contact process, and thereafter conveys medium PM to pair of registration rollers **22**. Subsequently, pair of registration rollers **22** (or, pairs of registration rollers **21**, **22**) conveys medium PM in conveyance direction F along conveyance path PW. At this time, sensor **25** detects medium PM while medium PM is passing a region opposed to sensor **25**. When sensor **25** detects medium PM, an operation of image formation unit **30** is started, medium PM is conveyed to transfer unit **40**, and a developer image formed in image formation unit **30** in the following manner is transferred onto medium PM. In this manner, an image is printed onto medium PM.

FIG. **6** schematically illustrates the respective voltages of photosensitive drum **31**, development roller **34**, and supply roller **35**, and the transition of developer **37**, when a developer image is formed. In image formation unit **30**, a developer image is formed by the following electrophotographic process. Firstly, power source unit **110** applies a charge voltage V_{32} to charge roller **32** to equally charge the surface (surface layer portion) of charge roller **32**, and along with the charge, a portion, within peripheral surface **31**A of photosensitive drum **31**, which is in contact with charge roller **32** is also charged to a predetermined voltage V_{31_R1} (for example, −600 volts). Subsequently, LED head **33** emits irradiation light toward the region (charged region R**1**) within peripheral surface **31**A of photosensitive drum **31**, which is charged to voltage V_{31_R1} to expose peripheral surface **31**A of photosensitive drum **31**, so that electrostatic latent image R**2** in accordance with a printing pattern defined by the above-mentioned printing job is formed on peripheral surface **31**A. At this time, voltage V_{31_R2} at a portion, within peripheral surface **31**A of photosensitive drum **31**, which corresponds to electrostatic latent image R**2** becomes, for example, approximately 0 volt.

Meanwhile, power source unit **110** applies a supply voltage V_{35} to supply roller **35** to cause the surface (surface layer portion) of supply roller **35** to have a predetermined voltage (for example, −400 volts). Similarly, power source unit **110** applies development voltage V_{34} to development roller **34** to cause the surface (surface layer portion) of development roller **34** to have a predetermined voltage (for example, −300 volts). At this time, supply roller **35** and development roller **34** that come into contact with each other respectively rotate at predetermined circumferential speeds. This causes negatively charged developer **37** to be attracted to development roller **34** due to a potential difference between supply voltage V_{35} and a development voltage V_{34}. As a result, developer **37** is supplied from the surface of supply roller **35** to the surface of development roller **34**. Subsequently, developer **37** on development roller **34** is charged due to friction or the like of regulation blade **38** that comes into contact with development roller **34**. Herein, the thickness of developer **37** on development roller **34** is determined based on development voltage V_{34}, supply voltage V_{35}, a pressing pressure by regulation blade **38**, and the like. Moreover, development roller **34** and photosensitive drum **31** that come into contact with each other respectively rotate at predetermined circumferential speeds. This causes negatively charged developer **37** to be attracted to photosensitive drum **31** due to a potential difference between development voltage V_{34} and voltage V_{31_R2} at the portion, within peripheral surface **31**A of photosensitive drum **31**, which corresponds to electrostatic latent image R**2**. As a result, developer **37** is adhered onto electrostatic latent image R**2** on photosensitive drum **31**. Further, negatively charged developer **37** is not attracted to charged region R**1** because voltage V_{31_R1} at the portion, within peripheral surface **31**A of photosensitive drum **31**, which corresponds to charged region R**1** is lower than development voltage V_{34}.

Thereafter, a developer image on photosensitive drum **31** is transferred onto medium PM due to an electric field between photosensitive drum **31** and the transfer roller in transfer unit **40**. Further, cleaning blade **39** scrapes off and removes developer remaining on the surface of photosensitive drum **31**. Subsequently, fixation unit **50** applies heat and pressure to the developer image on medium PM to fix the developer image onto medium PM.

The following describes an operation of image formation apparatus **1** in detail. Hereinafter, specifically, an operation of image formation apparatus **1** when photosensitive drum **31** starts a rotation from a stop state is described in detail. Note that, hereinafter, it is assumed that measurement unit **108** is a counter that measures the time in units of one second, and measurement unit **108** is configured as one of the functions of controller **101**.

FIG. **7** illustrates an example of a procedure of the operation of image formation apparatus **1**. FIGS. **8** and **9** illustrate examples of various kinds of waveforms in image formation apparatus **1**. Waveforms (A) in FIGS. **8** and **9** illustrate examples of the waveforms of surface voltage V_{31} at third point C of photosensitive drum **31**. Waveforms (B) in FIGS. **8** and **9** illustrate examples of the waveforms of drive voltage V_{104} to be applied to motor **104** connected to photosensitive drum **31**. Waveforms (C) in FIGS. **8** and **9** illustrate examples of the waveforms of charge voltage V_{32}. Waveforms (D) in FIGS. **8** and **9** illustrate examples of the waveforms of development voltage V_{34}. Waveforms (E) in FIGS. **8** and **9** illustrate examples of the waveforms of supply voltage V_{35}. In FIGS. **8** and **9**, ON (+) indicates that a voltage to be applied has a positive voltage value, whereas ON (−) indicates that a voltage to be applied has a negative voltage value. Moreover, in FIGS. **8** and **9**, $\Delta T\alpha$ indicates a time period (passage time period) necessary for a region from first point A to third point C in peripheral surface **31**A of photosensitive drum **31** to pass third point C with the rotation of photosensitive drum **31**.

Firstly, when controller **101** detects a power supply of image formation apparatus **1** being turned on, measurement unit **108** sets stop time period T_{off} at T_{max} (Step S**101**). T_{max} is a value not less than threshold value T_{th}. Stop time period T_{off} is set at T_{max} because measurement unit **108** cannot measure the time while the power supply of image formation apparatus **1** is turned off. Moreover, stop time period T_{off} is set at T_{max} because an actual stop time period of photosensitive drum **31** is considered to be more than threshold value T_{th}. When measurement unit **108** measures stop time period T_{off} from rotation stop time T**0** while the power supply of image formation apparatus **1** is kept on, Step S**101** above is omitted.

Next, controller **101** determines whether the above-mentioned printing job is present (Step S**102**). If the above-mentioned printing job is not present, in other words, before controller **101** accepts the above-mentioned printing job, controller **101** determines whether stop time period T_{off} is less than T_{max} (Step **S103**). As a result, if stop time period T_{off} is less than T_{max} and one second has passed from a previous count by a counter, controller **101** adds 1 to stop time period T_{off} (Step S**104**). On the other hand, if stop time period T_{off} is not less than T_{max}, controller **101** returns the processing to Step S**102**. Meanwhile, if stop time period T_{off} is less than T_{max} and one second has not passed from the previous count by the counter, controller **101** returns the processing to Step S**102** without adding 1 to stop time period T_{off}.

If the power supply of image formation apparatus **1** is detected as being turned on, stop time period T_{off} is always equal to T_{max} irrespective of a timing when the above-mentioned printing job is inputted. On the other hand, if the power supply of image formation apparatus **1** is kept on and the counter measures stop time period T_{off} from rotation stop time T**0**, stop time period T_{off} may be less than T_{max} or not less than T_{max} depending on the timing when the above-mentioned printing job is inputted. Note that, FIG. **8** illustrates examples of various kinds of waveforms (A) to (E) produced when stop time period T_{off} is not less than T_{max}. Moreover, FIG. **9** illustrates examples of various kinds of waveforms (A) to (E) produced when stop time period T_{off} is less than T_{max}.

When the above-mentioned printing job is inputted and sensor **25** detects medium PM, controller **101** instructs I/O port **102** to output a control signal for driving motor **104** connected to photosensitive drum **31**. In response to the instruction, I/O port **102** outputs a control signal for driving motor **104** connected to photosensitive drum **31** to drive circuit **103** provided to photosensitive drum **31** under the control of controller **101**. This causes drive circuit **103** provided to photosensitive drum **31** to output drive voltage V_{104} to motor **104** connected to photosensitive drum **31**. As a result, the rotation of motor **104** connected to photosensitive drum **31** is started (Step S**105**, T**1**). At this time, controller **101** instructs power source unit **110** to output charge voltage V_{32} (for example, −800 volts) that charges charge roller **32**. In response to the instruction, power source unit **110** starts to apply charge voltage V_{32} to charge roller **32** (Step S**106**, T**1**). This causes charge roller **32** to be negatively charged, for example, and first point A on peripheral surface **31**A of photosensitive drum **31** to have a negative voltage from charge roller **32**.

Controller **101** instructs setting unit **109** to compare stop time period T_{off} with threshold value T_{th}. In response to the instruction, setting unit **109** starts to compare stop time period T_{off} with threshold value T_{th}. Specifically, setting unit **109** determines whether stop time period T_{off} is more than threshold value T_{th} (Step S**107**). As a result, if stop time period T_{off} is more than threshold value T_{th}, controller **101** instructs power source unit **110** to output a positive voltage (initial voltage Vi) as development voltage V_{34} at which development roller **34** is charged. In response to the instruction, power source unit **110** starts to apply a positive voltage (for example, an initial voltage Vi of +150 volts) to development roller **34** (Step S**108**, T**1**). This causes development voltage V_{34} to become initial voltage Vi of +150 volts, for example, as illustrated in FIG. **10**A. As a result, negatively charged developer **37** is attracted to the positive voltage of development roller **34**, so that developer **37** on development roller **34** does not move to peripheral surface **31**A of photosensitive drum **31**.

Moreover, as a result of the above-mentioned determination, if stop time period T_{off} is not more than threshold value T_{th}, controller **101** instructs power source unit **110** to output a negative voltage (initial voltage Vi) as development voltage V_{34} at which development roller **34** is charged. In response to the instruction, power source unit **110** starts to apply a negative voltage (for example, an initial voltage Vi of −300 volts) to development roller **34** (Step S**111**). This causes development voltage V_{34} to become initial voltage Vi of −300 volts, for example, as illustrated in FIG. **10**B. As a result, negatively charged developer **37** is not attracted to charged region R**1** because voltage V_{31_R1} at the portion, within peripheral surface **31**A of photosensitive drum **31**, which corresponds to charged region R**1**, becomes lower than development voltage V_{34}.

After Step S**108** is executed, controller **101** determines whether photosensitive drum **31** rotates for passage time period ΔTα (Step S**109**). If photosensitive drum **31** rotates for passage time period ΔTα, controller **101** instructs power source unit **110** to stop the output of the positive voltage (initial voltage Vi). In response to the instruction, power source unit **110** stops the output of the positive voltage (initial voltage Vi) (Step S**110**, T**2**).

After Step S**110** is executed, or the application of a negative voltage (initial voltage Vi) to development roller **34** is executed because stop time period T_{off} is not more than threshold value T_{th}, controller **101** executes the following control. Firstly, at a predetermined timing, controller **101** instructs power source unit **110** to output a negative voltage (printing voltage Vp) as development voltage V_{34}, and instructs power source unit **110** to output a negative voltage (for example, −400 volt) as supply voltage V_{35}. In response to the instruction, power source unit **110** starts to apply a negative voltage (for example, a printing voltage Vp of −300 volts) to development roller **34** (Step S**111**, T**3**). This causes development roller **34** to have a negative voltage (for example, printing voltage Vp of −300 volts). Power source unit **110** further starts to apply a negative voltage (for example, supply voltage V_{35} of −400 volts) to supply roller **35** (Step S**111**, T**3**). This causes supply roller **35** to have a negative voltage (for example, supply voltage V_{35} of −400 volts). The timing when development voltage V_{34} changes to printing voltage Vp and the timing when supply voltage V_{35} is supplied to supply roller **35** are identical with each other, as illustrated in FIG. **8**, for example.

Thereafter, controller **101** determines whether a stop request of printing is made (Step S**112**). Controller **101** repeatedly executes Step S**112** before the stop request of printing is made. If the stop request of printing is made, controller **101** instructs I/O port **102** to output a control signal for stopping the driving of motor **104** connected to photosensitive drum **31**. In response to the instruction, I/O port **102** outputs a control signal for stopping the driving of motor **104** connected to photosensitive drum **31** to drive circuit **103** provided to photosensitive drum **31** under the control of controller **101**. This causes drive circuit **103** provided to photosensitive drum **31** to stop the supply of drive voltage V_{104} to motor **104** connected to photosensitive drum **31**. As a result, the rotation of motor **104** connected to photosensitive drum **31** is stopped (Step S**113**, T**0**).

At this time, controller **101** instructs power source unit **110** to stop the outputs of charge voltage V_{32}, development voltage V_{34}, and supply voltage V_{35}. In response to the instruction, power source unit **110** stops the supply of charge voltage V_{32}, development voltage V_{34}, and supply voltage V_{35} respectively to charge roller **32**, development roller **34**, and supply roller **35** (Step S**114**). Lastly, controller **101** sets stop time period T_{off} at 0 (Step S**115**).

[Effect]

Next, the following describes an effect of image formation apparatus **1**. Generally, an electrophotographic image formation apparatus is configured such that the surface voltage of a photosensitive drum is close to 0 volt immediately after a power supply is turned on or when a development unit is started up after a long standby state. When a normal development process is executed in that state, a negative voltage is applied to a development roller to negatively charge a developer on the development roller. At this time, a potential difference between the photosensitive drum and the development roller is generated, so that the negatively charged developer on the development roller is attracted to the photosensitive drum, and is consequently consumed wastefully. To cope with this situation, for example, it is conceivable to prevent a developer from being attracted to a photosensitive drum by applying a positive voltage to a development roller until a region of a peripheral surface of the photosensitive drum, where the surface voltage of the photosensitive drum is close to 0 volt, finishes passing the development roller.

FIG. **11** illustrates examples of various kinds of waveforms in an image formation apparatus according to a comparative example. FIG. **12** illustrates an example of the respective voltages (V_{31}, V_{34}, and V_{35}) of photosensitive drum **31**, development roller **34**, and supply roller **35**, and the transition of developer **37**, when a developer image is formed. In FIG. **11**, positive initial voltage Vi is applied to development roller **34** until a region of peripheral surface **31**A of photosensitive drum **31**, where surface voltage V_{31} of photosensitive drum **31** is close to 0 volt, finishes passing development roller **34**.

Meanwhile, in a case where an operation such as printing is ended and the photosensitive drum **31** is temporarily stopped, and immediately after the temporal stop, the operation such as printing is started again, the photosensitive drum **31** starts to rotate before the surface voltage of the photosensitive drum **31** is attenuated, in some cases. In this case, as illustrated in waveform (D) of FIG. **11**, assume that a positive initial voltage Vi is applied to development roller **34**. At this time, for example, as illustrated in FIG. **12**, developer **37** positively charged on development roller **34** is strongly attracted to the negatively charged surface of photosensitive drum **31**. This results in the wasteful consumption of developer **37** in the image formation apparatus according to the comparative example.

Meanwhile, in image formation apparatus **1**, the polarity of initial voltage Vi to be applied to development roller **34** is set based on stop time period T_{off} that is a period when the rotation of photosensitive drum **31** is stopped. Specifically, the polarity corresponding to stop time period T_{off} measured by measurement unit **108** is set as the polarity of initial voltage Vi, using development voltage table **120** or development voltage function **130** that is read from storage unit **107**. If stop time period T_{off} measured by measurement unit **108** is not more than threshold value T_{th}, the polarity of initial voltage Vi is set to be negative. If stop time period T_{off} measured by measurement unit **108** is more than threshold value T_{th}, the polarity of initial voltage Vi is set to be positive. The polarity of initial voltage Vi is set in this manner in image formation apparatus **1** to prevent developer **37** on development roller **34** from being attracted to the surface of photosensitive drum **31**, as illustrated in FIG. **10**A and FIG. **10**B, for example. As a result, the wasteful consumption of developer **37** can be reduced.

<2. Modification Examples>

The following describes modification examples of image formation apparatus **1** in the above-mentioned embodiment. Note that, hereinafter, the components common to those in the above-mentioned embodiment are assigned with the same reference numerals that are assigned in the above-mentioned embodiment. Moreover, explanations are made mainly to the components different from those in the above-mentioned embodiment, and explanations for the components common to those in the above-mentioned embodiment are omitted, as appropriate.

[First Modification Example]

In a first modification example, polar table **140** and polar function **150** are respectively used instead of development voltage table **120** and development voltage function **130**. Storage unit **107** stores therein polar table **140** and polar function **150** instead of development voltage table **120** and development voltage function **130**. Polar table **140** corresponds to a specific example of a "table" of the invention. Polar function **150** corresponds to a specific example of a "function" of the invention.

FIG. **13**A illustrates an example of polar table **140**. FIG. **13**B illustrates an example of polar function **150**. Polar table **140** is a table in which polarity P_{34} of development voltage V_{34} is associated with stop time period T_{off}. In polar table **140**, polarity P_{34} of development voltage V_{34} is minus (−) when stop time period T_{off} is t**1** and t**2**, and polarity P_{34} of development voltage V_{34} is plus (+) when stop time period T_{off} is t**3** to tn. Polar function **150** is a function in which polarity P_{34} of development voltage V_{34} is associated with stop time period T_{off}. In polar function **150**, polarity P_{34} of development voltage V_{34} is minus (−) when stop time period T_{off} is t**1** and t**2**, and polarity P_{34} of development voltage V_{34} is plus (+) when stop time period T_{off} is t**3** to tn.

In the first modification example, setting unit **109** sets the polarity of initial voltage Vi to be applied to development roller **34**, based on stop time period T_{off} measured by measurement unit **108**. Setting unit **109** uses polar table **140** or polar function **150** that is read from storage unit **107** to set polar data (P_{34}) corresponding to stop time period T_{off} measured by measurement unit **108**, as the polarity of initial voltage Vi. Setting unit **109** sets the polarity of initial voltage Vi to be negative when stop time period T_{off} measured by measurement unit **108** is not more than threshold value T_{th}. Setting unit **109** sets the polarity of initial voltage Vi to be positive when stop time period T_{off} measured by measurement unit **108** is more than threshold value T_{th}. In the first modification example, threshold value T_{th} is t**2**.

In the first modification example, in image formation apparatus **1**, the polarity of initial voltage Vi to be applied to development roller **34** is set based on stop time period T_{off} that is a period when the rotation of photosensitive drum **31** is stopped. Specifically, the polarity corresponding to stop time period T_{off} measured by measurement unit **108** is set as the polarity of initial voltage Vi using polar table **140** or polar function **150** that is read from storage unit **107**. If stop time period T_{off} measured by measurement unit **108** is not more than threshold value T_{th}, the polarity of initial voltage Vi is set to be negative. Meanwhile, if stop time period T_{off} measured by measurement unit **108** is more than threshold value T_{th}, the polarity of initial voltage Vi is set to be positive. The polarity of initial voltage Vi is set in this manner in image formation apparatus **1** to prevent developer **37** on development roller **34** from being attracted to the surface of photosensitive drum **31**, as illustrated in FIG. **10**A and FIG. **10**B, for example. As a result, the wasteful consumption of developer **37** can be reduced.

[Second Modification Example]

In a second modification example, development voltage table **160** and development voltage function **170** are respectively used instead of development voltage table **120** and development voltage function **130**. Storage unit **107** stores therein development voltage table **160** and development voltage function **170** instead of development voltage table **120** and development voltage function **130**. Storage unit **107** further stores therein threshold value Tf_{th}. Development voltage table **160** corresponds to a specific example of a "table" of the invention. Development voltage function **170** corresponds to a specific example of a "function" of the invention. Threshold value T_{fth} corresponds to a specific example of a "second threshold value" of the invention.

In the second modification example, measurement unit **108** measures temperature T_{60} of fixation unit **50** that fixes developer **37** onto medium PM. Temperature T_{60} of fixation unit **50** is a parameter that decreases as stop time period T_{off} increases. Medium PM corresponds to a specific example of a "medium" of the invention. Temperature T_{60} of fixation unit **50** corresponds to a specific example of a "physical amount" of the invention. Measurement unit **108** is, for example, a temperature sensor. Measurement unit **108** starts the measurement of temperature T_{60} of upper roller **51** or lower roller **52**, for example, when detecting a control signal that is outputted from I/O port **102** and is used to stop the driving of motor **104** connected to photosensitive drum **31**. Measurement unit **108** outputs measured temperature T_{60} to controller **101**. Measurement unit **108** further stops the measurement of temperature T_{60} of upper roller **51** or lower roller **52**, for example, when detecting a control signal that is outputted from I/O port **102** and is used to start the driving of motor **104** connected to photosensitive drum **31**.

Waveform (A) in FIG. **14**A illustrates an example of time-dependent change in surface voltage V_{31} at first point A of photosensitive drum **31**. Waveform (B) in FIG. **14**B illustrates an example of time-dependent change in charge voltage V_{32}. Note that, the horizontal axes in waveforms (A) and (B) in FIG. **14** indicate temperature T_{60} of fixation unit **50** that is correlated with the time, instead of the time. The temperature of fixation unit **50** become lower toward the right side on the horizontal axes in waveform (A) and (B) in FIG. **14**. The negative voltage becomes large toward the upper side on the longitudinal axis in waveform (A) in FIG. **14**A.

Simultaneously with the stop of the rotation of photosensitive drum **31**, charge voltage V_{32} is cut off and becomes 0 volt. Surface voltage V_{31} at first point A of photosensitive drum **31** is then attenuated with the elapse of time (with the decrease in temperature of fixation unit **50**), and eventually becomes 0 volt or a voltage close to 0 volt. Development voltage table **160** and development voltage function **170** contain data obtained by the measurement or the prediction of such attenuation of surface voltage V_3.

FIG. **15**A illustrates an example of development voltage table **160**. FIG. **15**B illustrates an example of development voltage function **170**. Development voltage table **160** is a table in which development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**. In development voltage table **160**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as temperature T_{60} of fixation unit **50** varies to Tf**1**, Tf**2**, Tf**3**, . . . , Tfn. Development voltage function **170** is a function in which development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**. In development voltage function **170**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as temperature T_{60} of fixation unit **50** varies to Tf**1**, Tf**2**, Tf**3**, . . . , Tfn.

Herein, Va is a voltage higher than surface voltage V_{31} and lower than 0 volt. Va is a voltage having a negative polarity, and includes negative polar data. Vb is a voltage higher than 0 volt. Vb is a voltage having a positive polarity, and includes positive polar data. Accordingly, development voltage table **160** is also a table in which the polarity of development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**. Moreover, development voltage function **170** is also a function in which the polarity of development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**.

Setting unit **109** sets the polarity of initial voltage Vi to be applied to development roller **34**, based on temperature T_{60} of fixation unit **50** measured by measurement unit **108**. Setting unit **109** uses development voltage table **160** or development voltage function **170** that is read from storage unit **107** to obtain polar data corresponding to temperature T_{60} of fixation unit **50** measured by measurement unit **108**, and sets the obtained polar data as the polarity of initial voltage Vi. Moreover, setting unit **109** uses development voltage table **160** or development voltage function **170** that is read from storage unit **107** to obtain polar data and development voltage data corresponding to temperature T_{60} of fixation unit **50** measured by measurement unit **108**, and sets the polarity and a voltage value of initial voltage Vi based on the obtained polar data and development voltage data.

Setting unit **109** sets the polarity of initial voltage Vi to be negative when temperature T_{60} of fixation unit **50** measured by measurement unit **108** is not less than threshold value Tf_{th}. Setting unit **109** sets the polarity of initial voltage Vi to be positive when temperature T_{60} of fixation unit **50** measured by measurement unit **108** is less than threshold value Tf_{th}. Threshold value T_{fth} is temperature T_{60} of fixation unit **50** when the voltage of electrostatic latent image R**2** on photosensitive drum **31** is at a predetermined value (threshold value V_{th}). Note that, threshold value Tf_{th} corresponds to temperature Tf**2**, for example, in development voltage table **160** and development voltage function **170**.

In the second modification example, in image formation apparatus **1**, the polarity of initial voltage Vi to be applied to development roller **34** is set based on temperature T_{60} of fixation unit **50**. Specifically, the polarity corresponding to temperature T_{60} of fixation unit **50** measured by measurement unit **108** is set as the polarity of initial voltage Vi, using development voltage table **160** or development voltage function **170** that is read from storage unit **107**. If temperature T_{60} of fixation unit **50** measured by measurement unit **108** is not less than threshold value Tf_{th}, the polarity of initial voltage Vi is set to be negative. If temperature T_{60} of fixation unit **50** measured by measurement unit **108** is less than threshold value Tf_{th}, the polarity of initial voltage Vi is set to be positive. The polarity of initial voltage Vi is set in this manner in image formation apparatus **1** to prevent developer **37** on development roller **34** from being attracted to the surface of photosensitive drum **31**, as illustrated in FIG. **10**A and FIG. **10**B, for example. As a result, the wasteful consumption of developer **37** can be reduced.

[Third Modification Example]

In a third modification example, polar table **180** and polar function **190** are used instead of development voltage table **120** and development voltage function **130**, respectively. Storage unit **107** stores therein polar table **180** and polar function **190** instead of development voltage table **120** and development voltage function **130**. Storage unit **107** further stores therein threshold value Tf_{th}. Polar table **180** corresponds to a specific example of a "table" of the invention. Polar function **190** corresponds to a specific example of a "function" of the invention. Threshold value T_{fth} of the invention is a specific example of a "second threshold value".

FIG. **16**A illustrates an example of polar table **180**. FIG. **16**B illustrates an example of polar function **190**. Polar table **180** is a table in which polarity P_{34} of development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**. In polar table **180**, polarity P_{34} of development voltage V_{34} is minus (−) when temperature T_{60} of fixation unit **50** is Tf**1** and Tf**2**, and polarity P_{34} of development voltage V_{34} is plus (+) when temperature T_{60} of fixation unit **50** is Tf**3** to Tfn. Polar function **190** is a function in which polarity P_{34} of development voltage V_{34} is associated with temperature T_{60} of fixation unit **50**. In polar function **190**, polarity P_{34} of development voltage V_{34} is minus (−) when temperature T_{60} of fixation unit **50** is Tf**1** and Tf**2**, and polarity P_{34} of development voltage V_{34} is plus (+) when temperature T_{60} of fixation unit **50** is Tf**3** to Tfn.

In the third modification example, setting unit **109** sets the polarity of initial voltage Vi to be applied to development roller **34**, based on temperature T_{60} of fixation unit **50** measured by measurement unit **108**. Setting unit **109** uses polar table **180** or polar function **190** that is read from storage unit **107** to set polar data (P_{34}) corresponding to temperature T_{60} of fixation unit **50** measured by measurement unit **108**, as the polarity of initial voltage Vi. Setting unit **109** sets the polarity of initial voltage Vi to be negative when temperature T_{60} of fixation unit **50** measured by measurement unit **108** is not less than threshold value Tf_{th}. Setting unit **109** sets the polarity of initial voltage Vi to be positive when temperature T_{60} of fixation unit **50** measured by measurement unit **108** is less than threshold value Tf_{th}. In the modification example, threshold value Tf_{th} is Tf**2**.

In the third modification example, in image formation apparatus **1**, the polarity of initial voltage Vi to be applied to development roller **34** is set based on temperature T_{60} of fixation unit **50**. Specifically, the polarity corresponding to temperature T_{60} of fixation unit **50** measured by measurement unit **108** is set as the polarity of initial voltage Vi, using polar table **180** or polar function **190** that is read from storage unit **107**. If temperature T_{60} of fixation unit **50** measured by measurement unit **108** is not less than threshold value Tf_{th}, the polarity of initial voltage Vi is set to be negative. If temperature T_{60} of fixation unit **50** measured by measurement unit **108** is less than threshold value Tf_{th}, the polarity of initial voltage Vi is set to be positive. The polarity of initial voltage Vi is set in this manner in image formation apparatus **1** to prevent developer **37** on development roller **34** from being attracted to the surface of photosensitive drum **31**, as illustrated in FIG. **10**A and FIG. **10**B, for example. As a result, the wasteful consumption of developer **37** can be reduced.

[Fourth Modification Example]

In a fourth modification example, development voltage table **210** and development voltage function **220** are used instead of development voltage table **120** and development voltage function **130**, respectively. Storage unit **107** stores therein development voltage table **210** and development voltage function **220** instead of development voltage table **120** and development voltage function **130**. Development voltage table **210** corresponds to a specific example of a "table" of the invention. Development voltage function **220** corresponds to a specific example of a "function" of the invention.

In the fourth modification example, measurement unit **108** measures surface voltage V_{31} of photosensitive drum **31**. Surface voltage V_{31} of photosensitive drum **31** is a parameter that decreases as stop time period T_{off} increases. Surface voltage V_{31} of photosensitive drum **31** corresponds to a specific example of a "physical amount" of the invention. Measurement unit **108** is, for example, a voltmeter. Measurement unit **108** starts the measurement of surface voltage V_{31} of photosensitive drum **31**, for example, when detecting a control signal that is outputted from I/O port **102** and is used to stop the driving of motor **104** connected to photosensitive drum **31**. Measurement unit **108** outputs measured surface voltage V_{31} to controller **101**. Measurement unit **108** further stops the measurement of surface voltage V_{31} of photosensitive drum **31**, for example, when detecting a control signal that is outputted from I/O port **102** and is used to start the driving of motor **104** connected to photosensitive drum **31**.

FIG. **17**A illustrates an example of development voltage table **210**. FIG. **17**B illustrates an example of development voltage function **220**. Development voltage table **210** is a table in which development voltage V_{34} is associated with surface voltage V_{31}. In development voltage table **210**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as surface voltage V_{31} of photosensitive drum **31** varies to V**1**, V**2**, V**3**, . . . , Vn. Development voltage function **220** is a function in which development voltage V_{34} is associated with surface voltage V_{31}. In development voltage function **220**, development voltage V_{34} varies to Va, Va, Vb, . . . , Vb as surface voltage V_{31} of photosensitive drum **31** varies to V**1**, V**2**, V**3**, . . . , Vn.

Herein, Va is a voltage higher than surface voltage V_{31} and lower than 0 volt. Va is a voltage having a negative polarity, and includes negative polar data. Vb is a voltage higher than 0 volt. Vb is a voltage having a positive polarity, and includes positive polar data. Accordingly, development voltage table **210** is also a table in which the polarity of development voltage V_{34} is associated with surface voltage V_{31} of photosensitive drum **31**. Moreover, development voltage function **220** is also a function in which the polarity of development voltage V_{34} is associated with surface voltage V_{31} of photosensitive drum **31**.

Setting unit **109** sets the polarity of initial voltage Vi to be applied to development roller **34**, based on surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108**. Setting unit **109** uses development voltage table **210** or development voltage function **220** that is read from storage unit **107** to obtain polar data corresponding to surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108**, and sets the obtained polar data as the polarity of initial voltage Vi. Moreover, setting unit **109** uses development voltage table **210** or development voltage function **220** that is read from storage unit **107** to obtain polar data and development voltage data corresponding to surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108**, and sets the polarity and a voltage value of initial voltage Vi based on the obtained polar data and development voltage data.

Setting unit **109** sets the polarity of initial voltage Vi to be negative when surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108** is not less than threshold value V_{th}. Setting unit **109** sets the polarity of initial voltage Vi to be positive when surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108** is less than threshold value V_{th}.

In the fourth modification example, in image formation apparatus **1**, the polarity of initial voltage Vi to be applied to development roller **34** is set based on surface voltage V_{31} of photosensitive drum **31**. Specifically, the polarity corresponding to surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108** is set as the polarity of initial voltage Vi, using development voltage table **210** or development voltage function **220** that is read from storage unit **107**. If surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108** is not less than threshold value V_{th}, the polarity of initial voltage Vi is set to be negative. If surface voltage V_{31} of photosensitive drum **31** measured by measurement unit **108** is less than threshold value V_{th}, the polarity of initial voltage Vi is set to be positive. The polarity of initial voltage Vi is set in this manner in image formation apparatus **1** to prevent developer **37** on development roller **34** from being attracted to the surface of photosensitive drum **31**, as illustrated in FIG. **10**A and FIG. **10**B, for example. As a result, the wasteful consumption of developer **37** can be reduced.

[Fifth Modification Example]

In the above-mentioned embodiment and the above-mentioned first to third modification examples, development voltage tables **120** and **160**, development voltage functions **130** and **170**, polar tables **140** and **180**, and polar functions **150** and **190** may be provided in consideration of the environment (temperature or humidity) inside housing **100**. In this case, measurement unit **108** is preferably configured to include a sensor that measures the temperature or the humidity.

The attenuation characteristic of surface voltage V_{31} when the rotation of photosensitive drum **31** is stopped differs depending on the environment (temperature or humidity) inside housing **100**, in a strict sense. Therefore, development voltage tables **120** and **160**, development voltage functions **130** and **170**, polar tables **140** and **180**, and polar functions **150** and **190** preferably include parameters related to the environment (temperature or humidity) inside housing **100**.

The attenuation characteristic of surface voltage V_{31} when the rotation of photosensitive drum **31** is stopped has such a tendency that the attenuation amount becomes large at high temperature and high humidity, whereas the attenuation amount becomes small at low temperature and low humidity. In other words, the attenuation time of surface voltage V_{31} is short at high temperature and high humidity, and is long at low temperature and low humidity.

Therefore, controller **101** preferably adjusts the above-mentioned parameters such that the polarity and the voltage value of initial voltage Vi at high temperature and high humidity have values adapted to the attenuation characteristic when the attenuation amount is large. Controller **101** preferably adjusts, for example, threshold value T_{th} to a smaller value or threshold value Tf_{th} to a higher value.

Moreover, controller **101** preferably adjusts the above-mentioned parameters such that the polarity and the voltage value of initial voltage Vi at low temperature and low humidity have values adapted to the attenuation characteristic when the attenuation amount is small. Controller **101** preferably adjusts, for example, threshold value T_{th} to a larger value or threshold value Tf_{th} to a lower value, at low temperature and low humidity.

In the modification examples, development voltage tables **120** and **160**, development voltage functions **130** and **170**, polar tables **140** and **180**, and polar functions **150** and **190** are provided in consideration of the environment (temperature or humidity) inside housing **100**. This allows the polarity and the voltage value of initial voltage Vi to be set in accordance with the environment (temperature or humidity) inside housing **100**. As a result, even when the environment (temperature or humidity) inside housing **100** is changed, the wasteful consumption of developer **37** can be reduced.

[Sixth Modification Example]

The following describes various kinds of modification examples.

In the above-mentioned embodiment and the modification examples thereof, although an image is transferred by a direct method, an image may be transferred by an indirect method. Moreover, in the above-mentioned embodiment, a monochromatic image formation unit **30** is used. However, in the above-mentioned embodiment and the modification examples thereof, a multicolor image formation unit **30** may be used. Moreover, in the above-mentioned embodiment, LED head **33** is used. However, in the above-mentioned embodiment and the modification examples thereof, a laser element or the like may be used, instead of LED head **33** or together with LED head **33**.

A series of processes described in the above-mentioned embodiment and the modification examples thereof may be implemented by hardware (circuit) or may be implemented by software (program). If the above-mentioned series of processes is implemented by software, the software is configured to include a group of programs causing a computer to execute the functions. The programs may be incorporated in the above-mentioned computer in advance, or may be installed in the above-mentioned computer from a network or a recording medium, for example.

In the above-mentioned embodiment and the modification examples thereof, a mode carrying out the invention is described using an electrophotographic printer as an example. However, the invention is not limited to the application to a color device or a printer, but can be applied to a typical image formation apparatus that forms an image on a conveyed medium. The invention can be applied to, for example, monochrome copiers, color copiers, monochrome MFPs, color MFPs, or the like.

In the above-mentioned embodiment, as a specific example of the "image formation apparatus" in the invention, an image formation apparatus having a printing function is described. However, the invention is not limited to the image formation apparatus having a printing function, but can be applied to an image formation apparatus that functions as a multifunction peripheral having a scanning function or a facsimile function, for example.

The invention includes other embodiments in addition to the above-described embodiments without departing from the spirit of the invention. The embodiments are to be considered in all respects as illustrative, and not restrictive. The scope of the invention is indicated by the appended claims rather than by the foregoing description. Hence, all configurations including the meaning and range within equivalent arrangements of the claims are intended to be embraced in the invention.

What is claimed is:

1. An image formation apparatus comprising:

an image carrier including a peripheral surface with a photosensitive element;

a charge member placed facing the peripheral surface and configured to charge the peripheral surface;

an exposure unit that exposes with light a charged region of the peripheral surface charged by the charge member to form an electrostatic latent image;

a development member placed facing the peripheral surface at a position downstream of the charge member in a rotation direction of the image carrier, and configured to develop the electrostatic latent image with a developer;

a measurement unit that measures a stop time period when a rotation of the image carrier is being stopped, or a physical amount that varies as the stop time period increases;

a setting unit that sets a polarity of an initial voltage to be applied to the development member, the polarity determined based on the stop time period or the physical amount measured by the measurement unit; and

a power source unit that applies the initial voltage with the polarity set by the setting unit to the development member, at rotation start time of the image carrier.

2. The image formation apparatus according to claim **1**, further comprising a storage unit that stores therein a table or a function in which the polarity of the initial voltage to be applied to the development member is associated with the stop time period or the physical amount, wherein

the setting unit obtains polar data corresponding to the stop time period or the physical amount measured by the measurement unit by using the table or the function read from the storage unit, and sets the obtained polar data as the polarity of the initial voltage.

3. The image formation apparatus according to claim **2**, wherein

the table is a table in which the polarity and a voltage value of the initial voltage to be applied to the development member are associated with the stop time period or the physical amount, and

the setting unit obtains polar data and development voltage data corresponding to the stop time period or the physical amount measured by the measurement unit, by using the table read from the storage unit, and sets the polarity and the voltage value of the initial voltage based on the polar data and the development voltage data thus obtained.

4. The image formation apparatus according to claim **3**, wherein, when setting the polarity of the initial voltage to be negative, the setting unit sets the voltage value of the initial voltage to a voltage value higher than a voltage value in the charged region.

5. The image formation apparatus according to claim **2**, wherein

the function is a function in which the polarity and a voltage value of the initial voltage to be applied to the development member are associated with the stop time period or the physical amount, and

the setting unit obtains polar data and development voltage data corresponding to the stop time period or the physical amount measured by the measurement unit, by using the function read from the storage unit, and sets the polarity and the voltage value of the initial voltage based on the polar data and the development voltage data thus obtained.

6. The image formation apparatus according to claim **1**, wherein the setting unit sets the polarity of the initial voltage to be negative when the stop time period measured by the measurement unit is not more than a first threshold value, and sets the polarity of the initial voltage to be positive when the stop time period measured by the measurement unit is more than the first threshold value.

7. The image formation apparatus according to claim **1**, wherein

the physical amount is a parameter that decreases as the stop time period increases, and

the setting unit sets the polarity of the initial voltage to be negative when the physical amount measured by the measurement unit is not less than a second threshold value, and sets the polarity of the initial voltage to be positive when the physical amount measured by the measurement unit is less than the second threshold value.

8. The image formation apparatus according to claim **1**, wherein the power source unit applies the initial voltage with the polarity set by the setting unit to the development member within a period from the rotation start time to transfer start time of a developer image formed by a development by the development member.

9. The image formation apparatus according to claim **8**, wherein, when the polarity of the initial voltage set by the setting unit is negative, the power source unit applies the initial voltage with a certain voltage value to the development member, the certain voltage value being equal to a voltage value of a voltage to be applied to the development member during printing.

10. The image formation apparatus according to claim **1**, wherein the physical amount is a temperature of a fixation unit that fixes the developer onto a medium.

11. The image formation apparatus according to claim **1**, wherein the physical amount is a surface voltage of the image carrier.

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